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A New Tool Grinder.

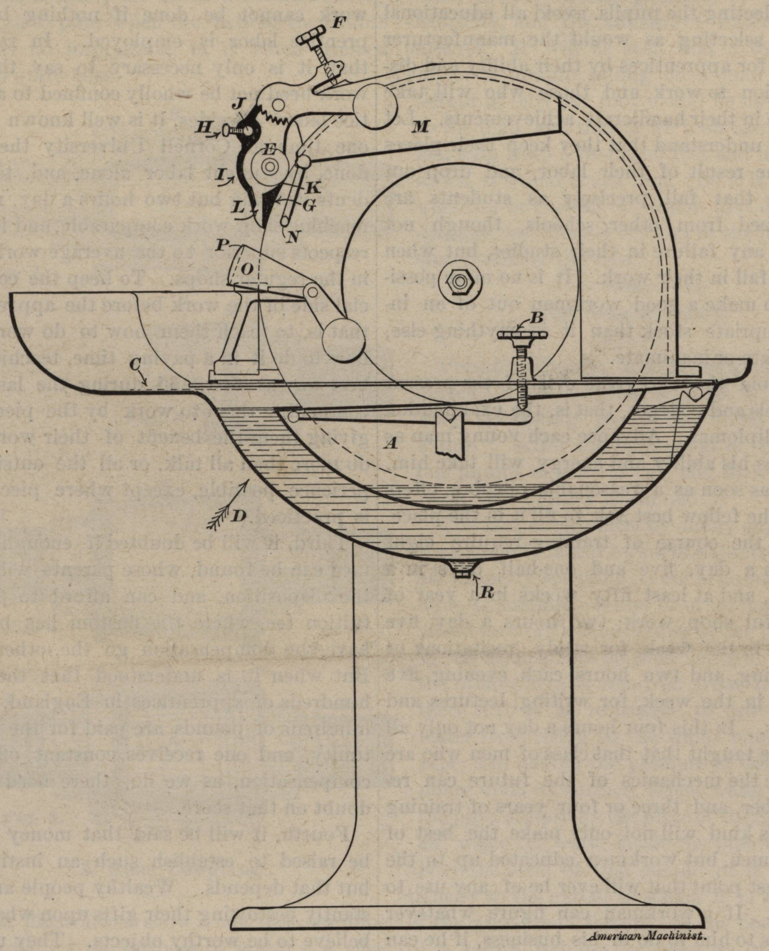
We present herewith engravings showing the construction of a new tool grinder, in designing which the effort has been made to overcome all the objections which have been found both to the time-honored grindstone, and its most recent competitor, the emery wheel tool grinder. The designers and builders of the machine have had much experience with grinding machinery in an establishment where it is made a specialty. How well they have succeeded in their effort to produce a machine in every way satisfactory for machine shop and other tool grinding, we leave for our readers to judge after reading the following description, which will be made clearer by reference to the accompanying detail view.

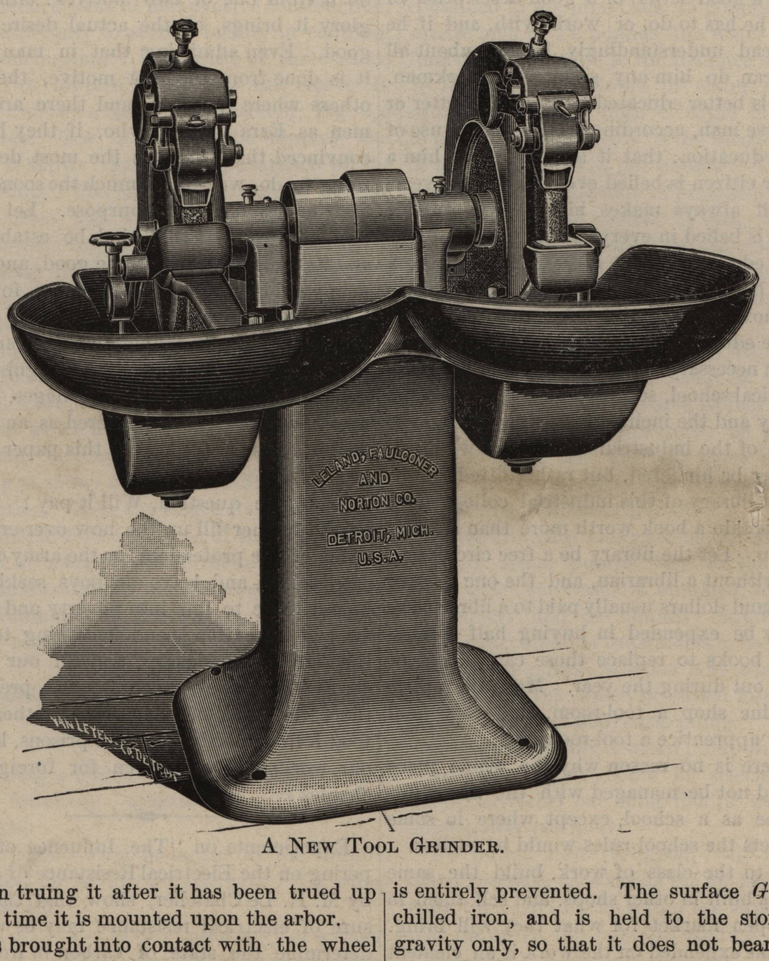
As will be perceived, the base of the machine is a rectangular column so arranged as to have plenty of bearing upon the floor to give it steadiness, and yet be out of the way of the operator in using the machine. At the top of this column is mounted the arbor, which runs in boxes that have special devices for lubrication, by which a quantity of oil can be put into them, and it will be continuously fed to the journal by felt wicks, and there are chambers so formed that all grit and sediment is left at the bottom. A wheel is carried at each end of the spindle, and things are so arranged that a wheel may be removed from or put on the spindle with little trouble, and without disturbing the spindle or boxes. The wheels may be alike or of different grades, or one, or both of them may be grindstones, if preferred; the makers of the machine furnishing when desired imported "free grit" grindstones, which can be run at the same speed as emery wheels, cost about one-fifth as much, and in use have proven very efficient and satisfactory. Emery wheels are also furnished, which are specially designed for such work as is done on this machine, and are preferred by many.

The front of the water pan is in the form of two semi-circles, as shown, so that, no matter where the operator stands, he will be at the same distance from the wheel—a feature which will be appreciated, we think, by those who have had experience with such machines. There are guards, which effectually prevent the throwing of water about the machine, or upon neighboring machinery, these guards being adjustable to the wheels, and held in position by bronze bolts, so that there is no trouble from rust when they are to be moved. Upon the rest is pivoted the guard *O*, which is counterbalanced, so that when not in use it rises above the rest; but when the tool is placed upon the guard at *p* it descends until the tool bears upon the rest, in either position doing much to prevent throwing of water, while at the same time it also prevents sudden gouging into the wheel, for the reason that the operator cannot force the tool suddenly against the wheel, because he must first place it upon the guard and force it down to the top of the rest, this act bringing the tool so near the wheel as to make sudden gouging difficult, if not impossible.

Special provision is made for keeping the wheels true, and in the best possible condition for effective work, by the truing device seen attached to the wheel guard above the rest. This consists of a threaded roll of steel running upon a hardened and ground arbor in bronze bearings, so designed as to be easily and cheaply replaced when worn, and intended to be used in keeping the wheel from getting out of truth rather than in truing it after it has been trued up at the time it is mounted upon the arbor.

It is brought into contact with the wheel by turning the small hand-wheel *F*, and, by being kept in light contact for a few minutes each day, the wheels are never perceptibly out of true, and great economy results from such practice, since very little of the wheel is consumed in truing up, and deep gouging is entirely prevented. The surface *G* is of chilled iron, and is held to the stone by gravity only, so that it does not bear hard upon it.




LELAND, FAULCONER AND NORTON CO. DETROIT, MICH. U.S.A.

A NEW TOOL GRINDER.

For a water supply no pumps, valves or other devices of that nature are made use of, yet the supply is under perfect control by the operator, and may be graduated from a merely moist wheel to a flood of water, by simply turning the hand-wheel *B*, which, as will be seen, is on a screw, which bears upon one end of a lever, which is fulcrumed as shown, and supports the front end of the tank *A*, the other end being pivoted at the back, as shown. When the machine is first started the tank or trough *A* is raised to its highest position, after which the wheels are started, and while they are running, water is poured into the pans in front, until it appears at the point *C*, the object being to fill the outer tank, but not the smaller one. Then by lowering the inner trough, by turning the screw *B*, water enters this trough, and the wheel is flooded. The supply is then reduced to suit the operator by adjusting the screw. It is not intended to shut off the water supply after using the wheel, but rather to let this be constant, so that the wheels may always be thoroughly and uniformly wetted. It is also recommended that the wheel be left running all the time. The water is of course carried to the outside of the wheel by centrifugal force, and is collected in the upper wheel guard, *G* being the water guide by which it is uniformly distributed over the surface of the wheel just above the point at which the grinding is done. It is balanced so that it will hang in what is thought to be its best position for ordinary conditions, but can be clamped in any desired position by the thumb-screw *H*. The water passes through the passage *L*, which should be kept clear. Water is also collected at each side of the guard, and is delivered to the sides of the wheel by the tubes *N*. It is found that a small amount of soda in the water not only prevents rust, but also improves the cutting qualities of the wheels.

The wheel spindle is of crucible steel, ground accurately to size with collars turned all over, to insure exact balance, and has bearings 2⅛ inches diameter, 8 inches long. The wheels are 24 inches diameter, 1½-inch face, and are 25½ inches apart. The cone pulley is for a 4-inch belt, one step being 7 inches diameter, the other 8.

The makers insist that the proper speed of the wheel is of the greatest importance, and that the countershaft (which is furnished with the machine) should therefore be run not less than 300 revolutions, nor more than 310.

The builders are the Leland, Faulconer & Norton Co., Detroit, Mich.

An Industrial University.

By Prof. John E. Sweet.

Constant applications, at the rate of from one to a half dozen a day, from bright young men, begging for opportunities to learn the machinist or foundry trade, compel me to think of the worn-out subject of the apprenticeship system, and the many times worn-out discussions upon it. Although not unmindful of the oft-repeated assertion that no student or apprentice can learn a trade at school, and being so thoroughly convinced that such a conclusion is wrong, and that it not only can be done, but done better in the same time than has ever been done, even in the best of places, the country machine shop, the writer is impelled to revive the subject in an aggressive manner.

To insure a fair understanding of the following suggestions, it may be well to emphasize the fact that, for every mechanical engineer thoroughly employed, there must be from ten to one hundred workmen, including draftsmen, blacksmiths, foundrymen and machinists, and no matter what, or how extended, or thoroughly technical their education may be, while they are executing the work designed and planned by the engineer, they are workmen. And it is well, too, to take into consideration the fact that while there are men, and plenty of them, whose highest ambition it is to have a thoroughly classical education, there are other men, and plenty of them, whose highest ambition is to be thorough workmen of some special kind. Which may be the higher ambition of the two, few ever stop to think; quite likely this generation would be nearly unanimous one way, and possibly the next generation (measuring the difference between the man who strives for a selfish aim and the one who works to improve things for the public good) be equally unanimous the other way. Be that as it may, workmen there certainly must be so long as industries go on as at present. So long as we inhabit the temperate zone people must have houses and clothing, furniture and machinery, and whatever else may be done, there must be masons and carpenters, tailors and shoemakers, cabinet makers and machinists, and we can never have these without they have first been apprentices somewhere, as trades can never be acquired in any possible way except by years of direct and prolonged application in the use of tools, directed by constant and inquisitive thought. Proprietors of engineering establishments, machine shops and manufacturing industries are largely indisposed toward the old apprentice system. Binding out their sons for a term of years is not an agreeable thing to contemplate for most parents, and the result is often bad for all concerned. The trades unions also, in many sections and industries, limit the number of apprentices to far below the number necessary to keep up the supply, and hamper those who are admitted, so the army of our workmen, if this nation is to keep pace with others, must be recruited either from foreign countries or by some system of school education. As has been proven by the industrial school in New York, where good workmen are trained in the art of bricklaying, stone-cutting, plastering, plumbing, etc., the writer believes the same can be done equally well in the machinist and other trades, and offers the following hints as to a method of procedure.

Hundreds will be ready to claim that the thing has been tried over and over with very indifferent success, or with no success at all. It is just here that will be found the greatest difference in opinion; for, according to the writer's idea, the thing has never been tried, or at least not to a fair extent or in the right way. The trade schools are started as schools, conducted as schools, and aim to teach the use of tools, drawing, mechanics, the English language, mathematics, and many of them other things also. Our universities and colleges that have a mechanical course, and the technical institutes, are all schools with machine shop, foundry and laboratory attachments—all quite right in their way, where the aim is the production of mechanical engineers; but to expect to have a school succeed in doing something except just what it is designed to do, is an unreasonable expectation.

If a sufficient endowment, not greater than has already been given in many places for a like purpose, was at hand, and the objective point was to establish a school where an apprentice was to have an opportunity to learn the machinist's trade, and nothing else, the natural way to proceed would be to build a machine shop—a good one, but in no way extravagant or particularly different from any good shop—and stock it with the regular machine tools, preferably of the various makes and kinds, adapted to a great variety of work, from bolt and pipe cutting to the grinding and measuring machine. Adjoining or in an adjacent building, have rooms for drafting, recitations, lectures, and a library, and, reversing the usual order, make these features attachments to the shop. Select men for teachers and instructors for the shop proper, whose sole qualifications are that they know how to do work, how to go to work to do a job, who are ready in resources and know the kinks in the trade, entirely regardless of whether they know how to design machinery, whether they know what makes a steam engine go, or whether they can read or write, except if a man knows how to read he may be better able to find out other people's ways, and therefore be the better man for the place. Select for teachers in the drawing-rooms, class-rooms and lecture platform, men from the ranks, but never from the ranks of its own pupils. But shop, tools and men should all aim towards the objective point, educating young men to be good machinists (not engineers whose business it is to know how and why), but workmen who shall know how to do. In selecting the pupils, avoid all educational tests, selecting as would the manufacturer boys for apprentices by their ability and disposition to work, and those who will take pride in their handicraft achievements. Let them understand that they keep their places by the result of their labor, and drop out those that fail, precisely as students are dropped from other schools, though not from any failure in their studies, but when they fail in their work. It is no more possible to make a good workman out of an inappropriate stock than it is anything else, animate or inanimate.

Avoid the two great evils of the present schools and colleges, that is, the examination and diplomas. Advance each young man as fast as his ability and energy will take him, and as soon as a reasonable opening offers put the fellow best able to fill it in the place.

In the course of training require eight hours a day, five and one-half days in a week, and at least fifty weeks in a year of faithful shop work; two hours a day, five days in the week, for study, recitations or drawing, and two hours each evening, five days in the week, for writing, lectures and study. In this four hours a day not only all can be taught that that class of men who are to be the mechanics of the future can remember, and three or four years of training of this kind will not only make the best of workmen, but workmen educated up to the highest point that will ever be of any use to them. If a workman can figure whatever comes to him to do in his business, if he can write a good letter or a good description of what he has to do, or work with, and if he can read understandingly, he has about all that can do him any good, as a workman. If he is better educated he may be a better or a worse man, according as he makes use of that education; that it always makes him a better citizen is belied every day in the year; that it always makes him a more reliable voter is belied in every charter election. The only education that *never* fails to make a man better is that education that teaches him how to earn a living by work.

The educational facilities should be such as are necessary to fit a young man to enter a technical school, so that where one shows the ability and the inclination to go beyond the scope of the industrial branch, he would in no way be hindered, but rather fitted for it.

The library of this industrial college need not contain a book worth more than a dollar or two. Let the library be a free circulating one without a librarian, and the one or two thousand dollars usually paid to a librarian as salary be expended in buying half a thousand books to replace those carried off or worn out during the year. Make the entire machine shop a tool-room, and each and every apprentice a tool-room boy.

There is no reason why the whole place should not be managed with the same discipline as a school, except where in some respects the school rules would be useless.

As to the class of work, build the same things built in other shops, and sell them in the open market for what they will bring. As time expended on the work is an element of no cost, the work after the third year could be certainly as well done as the average shop work, and, too, as the work cost does not enter into the product, all sorts of machines and tools could be built, and one of the best places imaginable to test new ideas provided. By doing this class of work no antagonism would be engendered with the regular outside shops; furnishing them with good men would gain friendship and aid, and any opposition from the trades union would only arouse public indignation, against which nothing but right can succeed. We can readily anticipate a score of objections that will be raised to this proposition.

First, it will be said it cannot be made to pay; in dollars and cents, no one with experience would expect it could; no school pays in that sense; but with the tuition fees, with the work free, with shop tools and power furnished, with instructors at small salaries, the drain on the endowment would be nothing comparable to that of the literary or technical colleges of the same magnitude.

Second, it will be said, good and salable work cannot be done if nothing but apprentice labor is employed. In reply to that, it is only necessary to say that the work need not be wholly confined to apprentice labor. Besides, it is well known that at one time at Cornell University there was done, by student labor alone, and, too, students working but two hours a day, regular machine shop work comparable, and in some respects superior to the average work done in the regular shops. To keep the commercial side of the work before the apprentices, that is, to teach them how to do work, and how to do it in a paying time, teaching the best way at first, and during the last year compelling them to work by the piece, and giving them the benefit of their work, will do more than all talk, or all the outside experience possible, except where piece-work is practiced.

Third, it will be doubted if enough young men can be found, whose parents will have the disposition, and can afford to pay the tuition fee, where the custom has been to have the compensation go the other way. But when it is understood that there are hundreds of apprentices in England, where hundreds of pounds are paid for the opportunity, and one receives constant offers of compensation, as we do, there need be no doubt on that score.

Fourth, it will be said that money cannot be raised to establish such an institution; but that depends. Wealthy people are constantly bestowing their gifts upon what they believe to be worthy objects. They usually do it from one or two motives: either the glory it brings, or the actual desire to do good. Even admitting that in many cases it is done from the first motive, there are others where it is not, and there are such men as Ezra Cornell, who, if they became convinced that this was the most desirable thing to do, would that much the sooner give their money for such a purpose. Let a certain institution of this kind be established, and its work be shown to be good, and other men would be ready to establish a foundry, a school of carpentry, of masonry, of carriage building, of cabinet making, and the like, and were these schools recognized by the State, and chartered as colleges, or the whole assembled and chartered as an industrial university, the title of this paper would be realized.

As to the question, Will it pay? Will it pay to further fill up the now over-crowded ranks of the professions, or the army of educated idlers, and leave our boys seeking an honest trade to fall into poverty and crime. Or had we better spend something to save them from debauchery, and fill our workshops with our own countrymen, preparing them for lives of usefulness, rather than food for our poorhouses and prisons, leaving our workshops the haven for foreign mechanics?

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Experiments on "The Influence of Tempering on the Electrical Resistance of Steel," by M. H. Le Chatelier, show that the measure of electrical resistance may be used to determine the state of carbon in iron, and also to find the proportion transformed in tempered steel.

Cores and Core Sands.

By Charles Smith.

There is a core sand which can be gotten at Oneida Lake, in New York State, possessing such valuable qualities for foundry use, that if more was known of it I feel it would be in more general use in our foundries. It is of a rich brownish color, and mixes readily with flour, rye meal, rosin, linseed oil or glue, and no matter which of the above substances is selected for a core mixture, if the lips are slightly parted and pressed firmly against cores made with this sand, the porosity is so great that one can blow through the sand without meeting much resistance, and port cores for small cylinders can be made with it, without venting, with perfect safety. But the best feature of this sand is that it will not scab, and peels from heavy machinery castings as though blacked with a rich coat of silver lead. On small cylinder cores, where barrel, ports and steam chest are being formed in one core-box at one operation—which is the quickest and most approved way of making them—trouble has always been experienced in blacking the surfaces, so much handling tending to crumble off the corners. On wheel hub cores, and many others that have to be dipped in liquid blacking and afterwards dried, with not always a neat job as the result, such a quality of sand ought to meet with general favor; there may be other lake sands equally as good, but the high qualities of this sand struck me so forcibly that I herewith present them.

Either flour, rye meal, or rosin have been the adhesive qualities added to our sands in making cores for generations. As generally used, the proportions are one-third new molding sand and two-thirds sharp sand, and to every eight—sometimes ten shovels of this sand—one shovel of flour, rye meal or rosin is added, and the whole wet down with thick clay wash, mixed thoroughly and riddled. If part of the sand is intended for small cores, more molding sand is added, and, with some slight modifications to suit the notion of the party in charge, the above is the formula used in the mixture for cores in nearly all our foundries to-day. Linseed oil and glue are coming into welcome prominence, both possessing qualities, when mixed with core sand, that recommend them to foundrymen. When linseed oil is used—and it can be used either raw or boiled, though many prefer the raw—the parts, one of oil to fifteen of sand, make an excellent core; if it works raw and sticky in the core-box, use about one-third molding sand and two-thirds sharp sand when preparing the mixture. But it is preferable to use all sharp sand on cores where difficulty is experienced in taking away the vent. It is hardly possible to produce anything that will make stronger cores than can be made with linseed oil and sand; they have extreme toughness without being brittle, and can be filed easily. In mixing this sand, apply the oil, and temper to suit with clear water. Large cores made from this mixture, owing to their yielding qualities, work safely in large engine frames or castings of such nature, where thin, or parts of unequal thickness, have to shrink on the core before it can be removed from the casting. For extremely large cores that go into heavy castings, where great care has to be exercised to keep the casting from cracking while shrinking on the core, the following mixture has been used in one of our very largest foundries with success: Six ordinary barrows of new molding sand; three barrows of sharp sand; one-half bushel of flour; one-half bushel of powdered rosin. Wet with clay wash.

Extra precautions can be taken by laying a piece of 1″ board, 2″ wide, and of a length long as the core-box will admit, on edge in the bottom of the cope side of the core-box, before ramming up the core, and when the core-box is turned over on the core-plate and taken off the core, the strip of wood can be taken from the top side of the core where it is imbedded. After the core is dried, the opening, lengthwise, on top of the core can be filled with green sand facing, and after the mold in which it has been inserted is poured, the core will have a chance to come together, as the casting contracts in cooling. This plan will be found to work well on large vertical engine frame cores.

This oil sand will also make excellent facing for dry sand work. the corners and frail parts of the mold having a toughness when oil is used, that flour, rye meal or rosin never imparts. Some foundries using daily hundreds of small cores make them almost entirely out of new molding sand, sometimes using one-twentieth part flour where an extra degree of toughness is desired. Of course, such cores must be handled tenderly when setting them in the molds, but the smooth surface they leave pays for the extra care in handling.

Clay wash, thinly mixed, is usually used to wet molding sand when it is being mixed for core making. Cores made from molding sand are not usually dried in ovens; they are made the day before they are intended to be used, and left on plates placed on shelves in a dry room.

Of course, all cores taking a horizontal position in the molds when set are well rodded. Large cores, no matter what the mixture in which they are rammed up, should be rodded thoroughly, that no license will be given them to go tumbling about your feet when you are sticking them together or swinging them on the crane to your molds.

Cast-iron skeletons, taking the shape of the core-box, and made strong, make the best kind of a backbone for a large core, but if to make them whole will tend to make trouble getting them free from the casting, they can be made in sections and bolted together, and the bolts removed and parts withdrawn, after the core in which they have done service is being removed from the casting.

Some molders black their cores after they come out of the ovens dried, and some black them when they are green, before drying; the latter course meets with most favor. because after the core is blacked when green, it can be slicked up smoothly and a really fine job made. Two coats should be given a core that will have a large body of metal around it, for, of the first coat a large quantity dries in or is absorbed by the core.

Whiting, diluted with water, clay wash, or molasses water, makes a wash sometimes used on cores. One-half Lehigh facing, and one-half silver lead mixed with clay wash into a dough and thinned down with molasses water, makes a good wash, easily and quickly made. But the best wash or blacking for general use on heavy cores, dry sand or loam—one that always can be relied upon to give satisfaction, and works well under slicking tool or brush, is made in the following way: Take one-half pail of silver lead, and pour onto it clay wash—fairly thick—and strained through a fine riddle. Mix all up until it comes thick like dough, and let it stand over night; that softens the grit. In the morning take out what quantity you wish to use, and thin down with molasses water, using one pint of molasses to a pail of water.

Glue is used in some foundries for making cores, and glue has the strongest kind of advocates, its users claiming for it all the good qualities that other adhesive substances used in core making possess, and claiming also that a glue core does not need venting. The cheapest kind of glue is always used. The glue is melted in a pot—usually out doors, for the smell is strong—and the parts one-third molding sand and two-thirds sharp sand are dried in the oven, and when taken out wet down with the melted glue; this forms a compound which is mixed with sharp sand, one part of the compound to five, six, and sometimes eight parts of sharp sand, depending upon the notion of the user or strength desired in the core. Sometimes to every fifteen shovels of the sharp sand added, one shovel of flour is used. The trouble of mixing glue core sand is a detriment to its general use.

Loam mixtures vary somewhat in nearly every shop where the article is used. One-half molding sand and one-half sharp sand, with one shovel of sawdust or horse manure to every eight of sand, wet down with clay wash, mixed about as thick as one would use in dipping gaggers, makes an excellent mixture. Sawdust works better than horse manure under sweep and slicking tool, and some very progressive foundrymen prefer using the former in loam mixing.

Another mixture successfully used in a large shop of prominence is composed of three parts sharp sand, one part new molding sand, one part of sawdust, wet with clay wash.

Some very nice castings are made from a dry sand facing with a green sand backing, the molds being blacked with liquid blacking, and skin dried after the patterns are drawn. In one shop where this operation is successfully performed, the dry sand facing is composed of one-half sharp sand and one-half new molding sand, one shovel of flour being added in mixing to every fifteen shovels of sand; the mold is considered dry enough to pour when the ball of the thumb makes no impressson in it when pressed down quite hard.

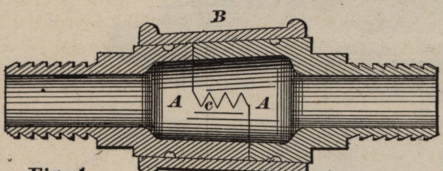

Fig. 1.

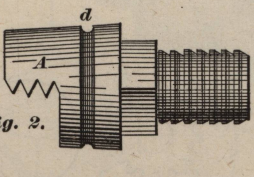

Fig. 2.

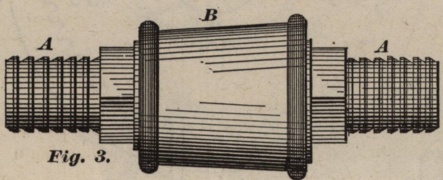

Fig. 3.

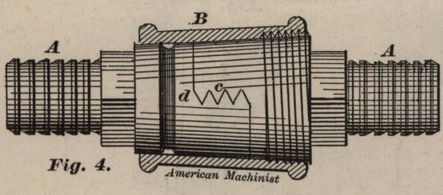

Fig. 4.

A Hose Coupling.

Our illustrations show a new hose coupling designed for the purpose of making a close and secure joint of inexpensive construction, and especially to secure facility in coupling and uncoupling. It consists of three parts, the two nipples, *A A*, and the sleeve *B*. Fig. 1 shows a longitudinal section; Fig. 2, a separate view of one of the nipples, and Fig. 3 shows the outer appearance of the coupling. The ends of the nipples overlap each other, and, when placed together, form a complete tube whose periphery has a slight tapering form; over this the sleeve *A* is fitted, which may be seated or unseated by a slight blow. To prevent the nipples from separating, they are serrated, as shown at *c*. To further insure a water-tight joint, the nipples are provided with peripheral grooves, *d d*, in which a rubber or other kind of packing may be used.

Fig. 4 shows a slight modification of construction. Here the sleeve *B* is drawn up by the thread formed on one of the nipples, instead of being driven on them.

These couplings are patented by William B. Dunning, of Geneva, N. Y., but they have not yet been placed on the market.

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Edison's Explanation of the Ampere and the Volt.

During a recent examination a lawyer put the following question to Thomas A. Edison:

"Explain what is meant by the number of volts in an electric current." To which he replied:

"I will have to use the analogy of a waterfall to explain. Say we have a current of water and a turbine wheel. If I have a turbine wheel, and allow a thousand gallons per second to fall from a height of one foot on the turbine, I get a certain power, we will say one horse-power. Now the one foot of fall will represent one volt of pressure in electricity, and the thousand gallons will represent the ampere, or the amount of current. We will call that one ampere. Thus we have a thousand gallons of water, or one ampere, falling one foot, or one volt, or under one volt of pressure, and the water working the turbine gives one horse-power. If, now, we go a thousand feet high, and take one gallon of water and let it fall on the turbine wheel, we will get the same power as we had before, namely, one horse-power. We have got a thousand times less current or less water, and we will have a thousandth of an ampere in place of one ampere, and we will have a thousand volts in place of one volt, and we will have a fall of water a thousand feet as against one foot. Now the fall of water, or the height from which it falls, is the pressure, or volts in electricity, and the amount of water is the amperes. It will be seen that a thousand gallons a minute falling on a man from a height of only one foot would be no danger to the man, and that if we took one gallon, and took it up a thousand feet and let it fall down, it would crush him. So it is not the quantity or current of water that does the damage, but it is the velocity or the pressure that produces the effect."

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The Steam Pump.

President Cronley, at a late meeting of the Jersey City Association N. A. S. E., read a very interesting paper on "The Steam Pump." After an explanation of the various pumps in general use, and their several parts, Mr. Cronley continued:

The idea entertained by many engineers, that water is raised by suction, is erroneous, as, properly speaking, there is no such principle as suction. Water or other liquids are raised through a tube or hose by the pressure of the atmosphere on their surface. When the atmosphere is removed from the tube there will be no resistance to prevent the water from rising, as the water outside the pipe, still having the pressure of the atmosphere upon its surface, forces water up into the pipe, supplying the place of the excluded air, while the water inside the pipe will rise above the level of that outside of it proportionally to the extent to which it is relieved of the pressure of the air. If the first stroke of a pump reduces the pressure of the air contained in the pipe from 15 pounds on the square inch to 14 pounds, the water will be forced up the pipe to the distance of about 2¼ feet, since a column of water an inch square and 2¼ feet high is equal in weight to about 1 pound. Now if the second stroke of the pump reduces the pressure of the atmosphere in the pipe to 13 pounds per inch, the water will rise another 2¼ feet; this rule is uniform, and shows that the rise of the column of water within the pipe is equal in weight to the pressure of the air upon the surface of the water without.

The distance that a pump will lift or draw water, as it is termed, is about 33 feet, because water of one inch area 33 feet weighs 14.7 pounds; but pumps must be in good order to lift 33 feet, and all pipes must be air-tight. Pumps will give better satisfaction lifting from 22 to 25 feet.

There are many things to be considered in locating steam pumps, such as the source from which the water is obtained, the point of delivery, and the quantity required in a given time; whether the water is to be lifted or flows to the pump; whether it is to be forced directly into the boiler, or raised into a tank 25, 50 or 100 feet above the pump.

When purchasing a steam pump to supply a steam boiler, one should be selected capable of delivering one cubic foot of water per horse-power per hour.

No pump, however good, will lift hot water, because as soon as the air is expelled from the barrel of the pump the vapor occupies the space, destroys the vacuum, and interferes with the supply of water. As a result of all this the pump knocks. When it becomes necessary to pump hot water, the pump should be placed below the supply, so that the water may flow into the valve chamber.

The most necessary condition to the satisfactory working of the steam pump is a full and steady supply of water. The pipe connections should in no case be smaller than the openings in the pump. The suction lift and delivery pipes should be as straight and smooth on the inside as possible.

When the water contains chips, shavings or sawdust, a strainer should be placed on the lower end of the pipe.

When the lift is high, or the suction long, a foot valve should be placed on the end of the suction pipe, and the area of the foot valve should exceed the area of the pipe.

A suction air chamber is a great advantage to the pump when the lift is high.

The area of the steam and exhaust pipes should in all cases be fully as large as the nipples in the pump to which they are attached.

The cylinders of steam pumps should in all cases be oiled before starting in the morning or stopping at night.

Stuffing-boxes on the piston and valve rods should in all cases be kept well filled with soft and moist packing, as, if the packing is allowed to become hard and dry, it will flute the rods, inducing leakage, and necessitating repairs.

The air vessel on the delivery pipe of the steam pump should never be less than five times the area of the water cylinder.

When pumps are standing still, idle, or out of service, in cold weather, all the drain, drip and pet-cocks should be left open.

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Accuracy that can be Practically Attained by Hand Work.

By Jarno.

In an order, or in a drawing, for any mechanical work, it is often a great help to figure the limits between which the size of a piece can be allowed to vary. Oftentimes a preferable limit is the one that is practical without involving extra expense. A ten-thousandth inch is a common extreme limit for the variation of standard gauges. To make one to a fourth of this limit might cost twice the amount of a common gauge. Care in stating limits often saves time writing letters back and forth. Though we live in an age of mechanical accuracy, yet the mechanics that do the best work are those that often employ the words, "accurate to within certain limits."

As to the exact meaning of terms, if there can be both a variation larger and a variation smaller than the standard, then the amount of limit is equal to the sum of these two variations. For instance, if a piece can vary an eighth inch from one inch, then the size can be anywhere between seven-eighths and one and an eighth inch, and the limit is a quarter inch in all. In stating that a piece can be filed practically to a variation of not more than a thousandth of an inch from the standard, I mean that the piece filed may be either larger or smaller than the standard to the amount of this variation, and that the extreme limit of variation between two pieces

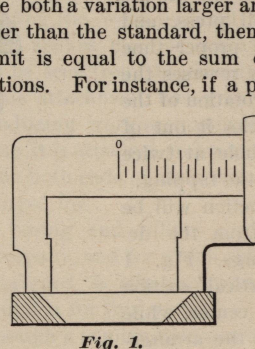

Fig. 1.

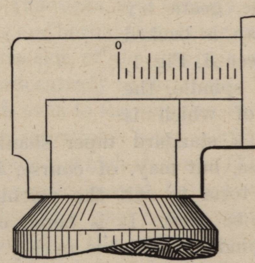

Fig. 2.

filed may be two one-thousandths of an inch. It costs time and money to be exact in mechanism; it costs correct thinking to be exact in language. Of that accuracy, which can be possibly attained in mechanical work, the one that knows the most says the least. The distance between accurate and exact may be short, but the time is likely to be very long.

It is about twice as difficult to draw a line accurately in position as it is to cut accurately to a line. That is, at any single trial, the variation in drawing a line is likely to be twice as much as in cutting to one already drawn right. These precautions have been found helpful. Have a scale whose lines are not more than three one-thousandths inch wide. Do not expect dividers to step off a distance accurately after simply setting them to a scale, but adjust them, and measure the distance that they actually do step off, until it is accurate. If convenient, draw a circle with them, and measure it, because this measurement shows their error doubled. Do not let a scratch awl turn in the fingers, because its point may not be central.

Another case of seeing the distance to be cut off, is that which is judged of by looking at a strip of light between two pieces. This is a still more accurate way of testing hand work, in pieces not more than one-eighth inch thick, touching upon their edges, because between them light can be seen through a space only a four-thousandth inch wide. Between a flat surface and a cylindrical piece not more than two inches diameter, with a common magnifying glass, a strip of light can be seen through a space a ten-thousandth inch wide. Hence, if two thin pieces be fitted together so as to shut out light, they do not vary more than this amount.

Measuring by the corners of caliper nibs, as in Figs. 1 and 2, is not likely to be so accurate as either of the foregoing ways. If the corners of the nibs are worn, which they are very likely to be, they take in a distance longer than the caliper testing indicates. In calipering the diameter of a chamfer, as in the figures, there seems to be some effect of light that tends to make the diameter appear right when it is really too large. This tendency is in both outside and inside chamfers, as shown in the figures.

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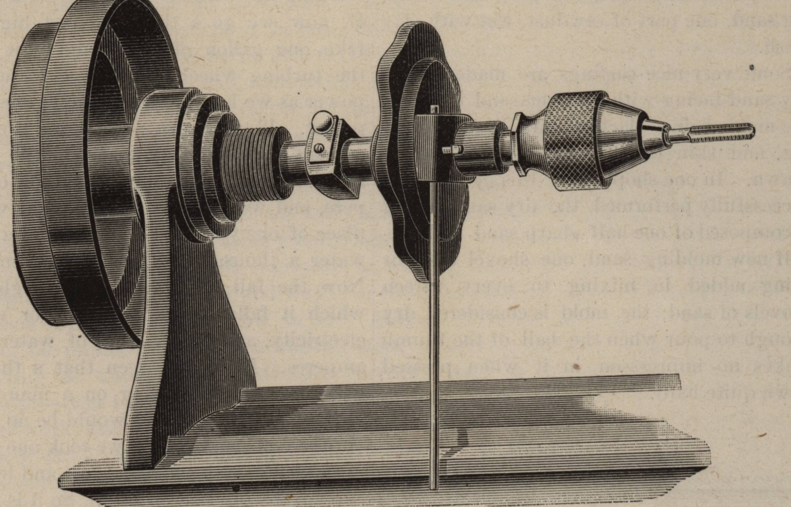
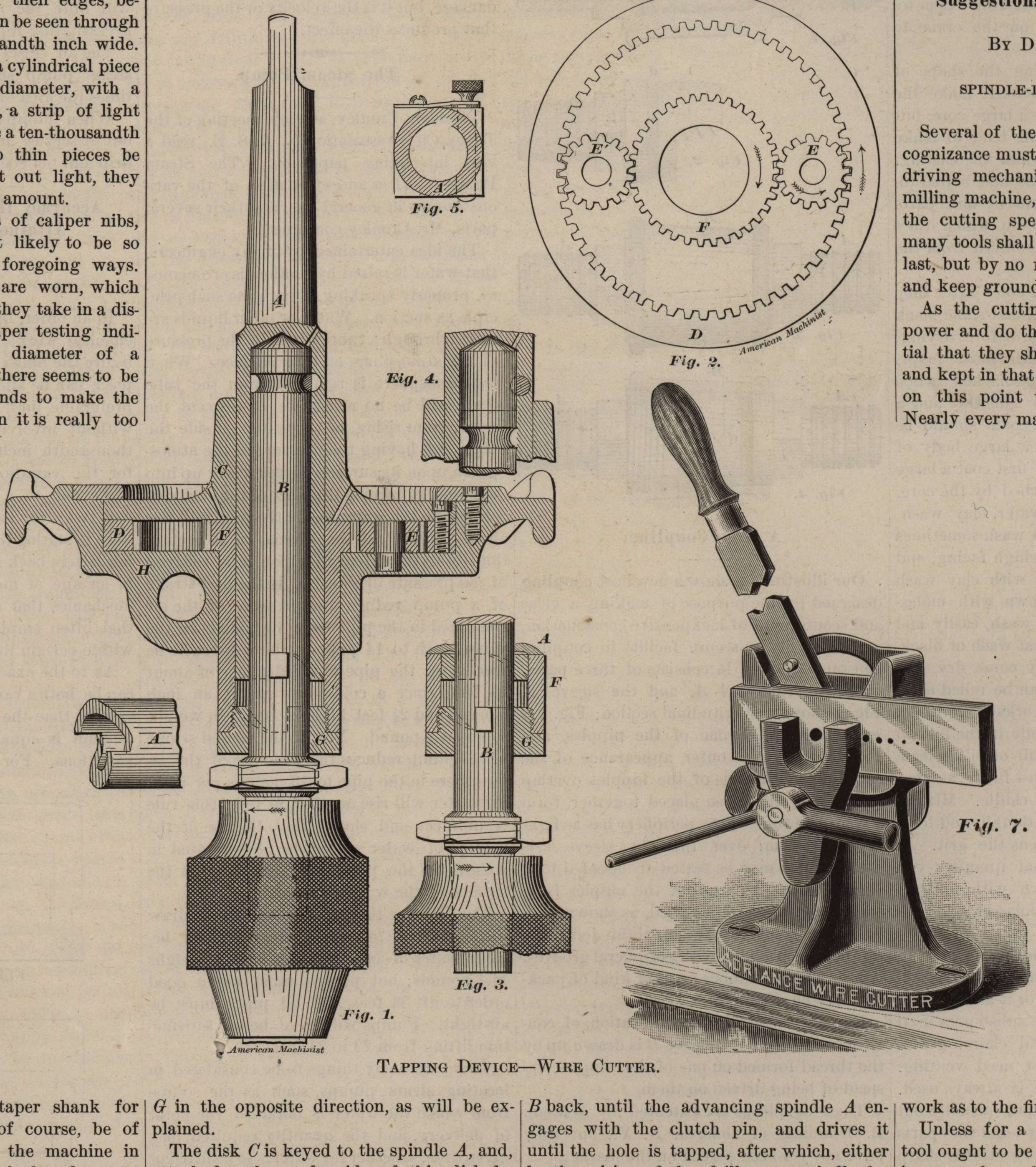
Tapping Device—Wire Cutter.

We present on this page, engravings of a tapping device which is adapted to be used either in the lathe or drill press, and which at the proper time automatically reverses the direction of rotation of the tap, and backs it out of the tapped hole at twice the speed of the tapping.

Its construction will be understood from the detail engravings, Fig. 1 being a vertical section through the center, while Fig. 2 shows the arrangement of the gears by which the tap is backed out. The piece *A*, Fig. 1, is the main spindle, the upper end of which is shown, with a standard taper shank for the drill press, but may, of course, be of any desired form to suit the machine in which it is to be used. It is bored out to receive the spindle *B*, which is an easy working fit within it, and may be driven directly from it by means of the clutch formed at the lower extremity of *A*, and the square clutch pin passing through *B*, and which is adapted to engage with the clutch when the spindle *B* is raised to the position shown in the section, Fig. 1. The spindle *B* may be permanently held in this position by means of the semi-circular groove near the top, which is engaged by the pin which passes through *A* and is flatted on one side, a plan view of this arrangement being shown by Fig. 5. When in this position, the spindle *B* is of course driven directly from spindle *A*, and by means of the drill chuck may be used for drilling holes in the ordinary manner, the entire device revolving together without wear upon its gears or other mechanism, though the plate *H* may be held still without affecting the motion of spindle *B*, the only result of this being to cause the gears to revolve and drive the lower clutch *G* in the opposite direction, as will be explained.

The disk *C* is keyed to the spindle *A*, and, attached to the under side of this disk by screws, is the internal spur gear *D*, which drives the two pinions *E* and *E'*, which are mounted upon studs fixed in the disk *H*, these pinions in turn driving the spur gear *F*, which is the top of and part of a sleeve, as shown by the section, and works freely within disk *H*, and upon spindle *A*, the lower end of this sleeve being internally threaded to receive the clutch *G*. It will thus be seen that when disk *H* is held from revolving, clutch *G* will be driven in the opposite direction from spindle *A*, and with the proportions of the gears shown, at twice the speed. Now, if the small pin which passes through *A* be so turned as to let the spindle *B* drop down, as shown by Fig. 4, until the square clutch pin engages with clutch *G*, the motion of the spindle *B* and the chuck will be reversed. In tapping, it is, of course, intended to use the device with the spindle *B* free to move up or down to engage with either clutch, the tap coming in contact with the work holding the spindle *B* back, until the advancing spindle *A* engages with the clutch pin, and drives it until the hole is tapped, after which, either by the raising of the drill-press spindle by the operator, or by its coming in contact with a stop previously set for the right depth, this clutch is disengaged, and the lower one being thrown in rapidly backs the tap out. The disk *H* may be held when tapping, either by means of a round bar passed through the hole provided for that purpose, or when using small taps it may be held by hand. The cut, Fig. 6, shows the device as in use with a lathe.





Tapping Device—Wire Cutter.

At Fig. 7 is shown a bench wire cutter made by the same manufacturers, the Adriance Machine Works, Plymouth and Jay streets, Brooklyn, N. Y. In this wire cutter the holes through which the different sizes of wire to be cut are passed are drilled through a plain piece of tool steel, which may be clamped in proper position for the use of any one of the holes, by means of the clamp and screw shown. The cutting lever is adapted to cut on either of its sides, and the end is so shaped as to form the pivot upon which it turns, thus securing an unusually large pivot bearing, and with the further advantage that the lever can be instantly lifted out and reversed, bringing a new cutting edge into use. All four of its corners may thus be used until dull, after which it may be ground to an edge again. The die piece may also be readily reversed in its position, to use either end of the holes, or turned upside down, to bring the other side of the same end into use as the cutting edge, and this may also be readily ground when dull.

A gauge is provided, by which pieces of any desired length may be cut off. It will be seen that this wire cutter is remarkable for its simplicity of construction, and the facility with which a new cutting edge may be brought into action when one becomes dull.

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Suggestions in Machine Design.

By D. C. Woodward.

SPINDLE-DRIVING MECHANISM.

Several of the important things of which cognizance must be taken in designing the driving mechanism of a lathe, planer or milling machine, are the material to be cut, the cutting speed for each material, how many tools shall be in operation at once, and last, but by no means least, who will grind and keep ground the cutting tools.

As the cutting tools are to absorb the power and do the required work, it is essential that they should be properly sharpened and kept in that condition, and a few words on this point will not be out of place. Nearly every machinist or would-be machinist, whether he has been in the shop thirty years, or only as many days, says that no one but himself can grind a tool to suit him, and therefore he must grind his own tools. As none of them ever grind a tool twice of the same shape, it would be interesting to know how many different shapes are produced in the course of a year by all the men in the country.

It being plainly evident that all of these cannot be the correct shape to cut the smoothest and require the least power, it is gratifying to note that two concerns are building machines for grinding lathe and planer tools, which will grind a tool to almost any shape that is desirable, and any number of tools to the same form, giving to the apprentice just as good tools with which to work as to the first-class machinists.

Unless for a special purpose, a machine tool ought to be so designed as to work cast-iron, steel or bronze, with nearly equal facility. As soft brass requires much less power and higher cutting speeds, it is better to design a special driving gear when the machine is to be used largely or entirely on brass work.

The present growing tendency is to put just as many tools at work at one time as is consistent with the shape and strength of the piece to be operated upon. Planers are built with two heads on the cross-rail, and one on each of the housings, so that four tools may be brought into operation at once. In like manner, a turret lathe may have a boring bar with double-end cutters, and some other special cutter on the turret, also a single or compound tool on the carriage, all of which may be in operation together.

By increasing the amount of power absorbed in useful work in each machine, the shop capacity is increased, and the cost of manufacturing decreased. That the highest efficiency may be attained in machines, and from this the highest shop efficiency and economy in manufacturing, it is necessary to place a minimum limit on the size of work to be done by the machine, or, in other words, every piece of work should be done in the smallest machine that will do it.

As lathes have not been built with sufficient stiffness and power necessary to do the work that ought to be done in them, machinists and shop foremen have become accustomed to doing work with machines that, although in nominal size, are three or four times too large, will hardly do the work.

An ordinary 12″ lathe will swing from 6″ to 8″ over the carriage, but in more than nine cases out of ten, where a foreman has a 6″ bar of iron, six or seven feet long, or even much shorter, he will send it to any machine from a 20″ to a 60″ lathe. The simple reason for this bad practice is, that it is practically impossible to do such a piece in any 12″ lathe, as at present built.

Probably 90 per cent. of all the wrought-iron and steel pieces operated upon in a lathe are less than 6″ diameter, and it is safe to say that not one-fourth of this amount is done in smaller than 16″ lathes.

A remedy for this very unbusiness like method of doing work is to condense the material and power that are in 24″ and 30″ lathes into an equal number of 12″ lathes of proper design, which would do more and better work, and occupy less floor space.

Both filing and polishing in a lathe require high speeds, but the most accurate and highest finished work is not produced by filing in a lathe, neither is it best to use all lathes for polishing purposes.

A better understanding of the pros and cons of a driving gear may be obtained by following through some particular size, which may be assumed as a 21″ lathe.

With a head-stock solid to the bed, and a spindle of 6″ diameter, it is essential, in order to preserve "the eternal fitness of things," to have a driving gear that will drive.

Assume as the slowest speed 5 revolutions of the spindle per minute, which would be about $27\frac{1}{4}$ feet per minute cutting speed for the full swing of the lathe. This would be a little slow for soft cast-iron, but for phosphor bronze, wrought-iron and steel, would probably be about as much too fast.

As large pieces often have a small hole, or a small part to be turned, it is necessary to have a much higher speed than would otherwise be required.

Assuming one inch as the least diameter for economy, and 40 feet per minute as the fastest cutting speed for this diameter, the greatest number of revolutions per minute would be 150.

Below this point any small reduction in diameter increases very rapidly the number of revolutions per minute for the same cutting speed. Thus, if the limit was placed at $\frac{1}{2}''$ diameter, it would require 300 revolutions per minute, which would be so great a difference from the other limit as to cause more loss in economy in working large diameters than is gained in small diameters.

In a perfect lathe, a constant cutting speed could be obtained for every diameter, and any speed between the limits could be secured instantly. The greater the number of possible speeds, and the greater the number that can be had instantly, the nearer is the machine approaching to the ideal.

To improve somewhat on the ordinary four-step cone, which, with back gear, gives eight speeds, assume the total number of speeds to be twelve, four of which are to be obtained instantly. To accomplish this will require a three-step cone, friction back gear, and an extra forward speed by the countershaft.

With five revolutions per minute as the slowest, and 150 revolutions per minute as the fastest speed of the spindle, the following will be the twelve speeds arranged in geometrical progression:

1— 5
2— 6.81
3— 9.28
4—12.64
5—17.23
6—23.46
7— 31.97
8— 43.55
9— 59.30
10— 80.80
11—110.10
12—150.

The ratio of the two speeds of the countershaft is the ratio of the first speed to the second, or 1 to 1.362. The back gear ratio is 1 to 6.393, which is the ratio of the first to the seventh.

The odd speeds, 1st, 3d, 5th, 7th, 9th and 11th, will be produced by the slowest speed of the countershaft, and the even numbers, 2d, 4th, 6th, 8th, 10th, and 12th, by the faster speed of the countershaft.

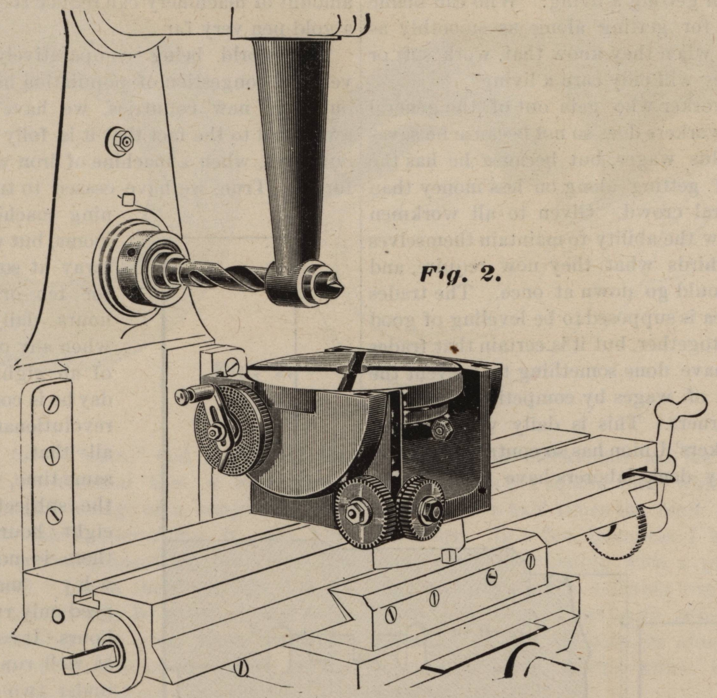

Fig. 2.

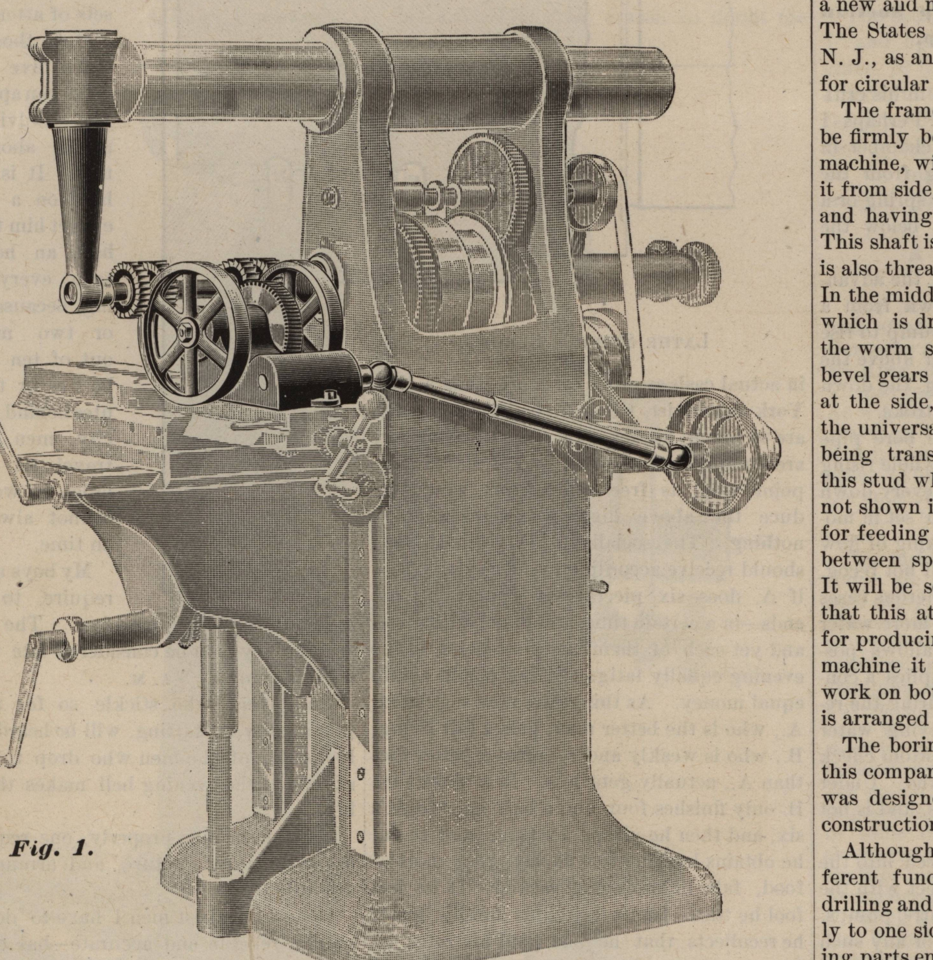

Fig. 1.

Circular Milling Attachment.

The division of speeds will then be:

1st countershaft speeds.		2d countershaft speeds.	
1st 3d 5th	with back gear.	2d 4th 6th	with back gear.
7th 9th 11th	without back gear.	8th 10th 12th	without back gear.

Thus, if the belt is on the large step of the lathe cone, and the first countershaft speed is used with back gears, the spindle will revolve five times per minute; without back gear, 31.97 turns per minute. If the belt remains the same, and the second countershaft speed is used, the spindle will make 6.81 turns with back gear, and 43.55 turns per minute without back gear. As these four speeds are obtained by a simple movement of the levers, any one of them may be brought into action instantly without change of belt.

If the cone on the countershaft and the one on the lathe are alike, and the diameter of the largest step is 18″, the diameters of the other steps will be $13\frac{7}{8}''$ and $9\frac{11}{16}''$.

The slowest speed of the countershaft will be 59.3 revolutions per minute, which will give a belt speed of 150 feet per minute, with belt on largest step of lathe cone. The ratio of belt speed to cutting speed for 21″ diameter of work will be 5.45 to 1.

The ratio of the belt to the cutting speed on a lathe built by one of the best known makers, is 6 to 1, another lathe 6.6 to 1, while the ratio on a 30″ planer is 55 to 1, a 48″ planer 87 to 1, and on some planers it is over 100 to 1.

Although all the authorities on belting agree that a high belt speed produces the most efficient results when transmitting power through belting, it is not practicable to reach a very high belt velocity where the power is to be continued through gearing, as it is in the lathe.

It is possible, however, and quite essential, that the present speed should be materially increased.

In the larger lathes the cone is removed from the spindle, and another gear and pinion are added to the driving mechanism, giving what is sometimes called a triple back gear.

If a similar arrangement is introduced on this 21″ lathe, the belt speed will be greatly increased, and the powerful driving gear so obtained will be in keeping with the solid bed and head-stock, and the large spindle previously described.

If this added gear and its pinion are in the proportion of 5 to 1, the fastest speed of the countershaft will be 404 revolutions per minute, the slowest 297, the fastest belt speed will be 1,890 feet per minute, and the slowest 750 feet per minute, which gives 27 to 1 as the ratio of belt speed to cutting speed.

A still greater ratio may be obtained by a material increase in the diameter of the cone. As the friction in journals is dependent on pressure and number of revolutions, this increase in diameter is the best way to obtain the desired results, for it means narrower belts and less pressure on the bearings due to the belt pull with the same number of revolutions.

If in this case the diameter of the large step of the cone is 27″ instead of 18″, the ratio will be increased one-half, or will be 40 to 1, and the corresponding belt speed will be 1,125 feet per minute.

These are not high belt velocities, but are a step forward, and will do much toward making a powerful driving gear with narrow and durable belts.

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Circular Milling Attachment.

The illustration, Fig. 1, on this page shows a new and novel tool designed and made by The States Machine Company, of Newark, N. J., as an attachment to milling machines for circular milling.

The frame is a hollow casting, arranged to be firmly bolted to the platen of a milling machine, with a shaft which passes through it from side to side at one end 3″ in diameter, and having bearings the full width of 10″. This shaft is bored out to receive arbors, and is also threaded on both ends for face plates. In the middle is keyed a worm gear wheel, which is driven by a worm at the bottom, the worm shaft being driven by means of bevel gears from the shaft, which passes out at the side, and to which can be attached the universal feed shaft as shown, this shaft being transferred from the platen feed to this stud when in operation. A hand-wheel, not shown in the cut, is conveniently placed for feeding the work by hand when milling between spokes, etc., or whenever desired. It will be seen from the description and cut that this attachment has great advantages for producing work economically, when the machine it is attached to has power to carry work on both ends of the work spindle, as it is arranged for.

The boring and milling engine built by this company, and for which this attachment was designed, is admirably adapted by its construction for this work.

Although a combination machine, the different functions are entirely distinct; the drilling and boring parts being confined entirely to one side of the machine, and the milling parts entirely to the other. This division extends even to the spindles, the drilling and boring operations being performed wholly by a spindle which traverses 13″ through the main spindle, moved by a new screw feed directly from the back, while the main spindle takes the milling operations only. This main spindle (of cold drawn steel), 3″ in diameter, has the forward end threaded 1″, and on this all the milling arbors, chucks, etc., are screwed. By this construction, and the adjustable arm, 6″ in diameter, with the patent drill jig pendant, arbors 22″ long can be used.

The milling feed, by a new device, is taken from a shaft directly over the main spindle, and when the machine is used for boring, the large gear is slipped back off the key, but when the milling feed is to be used the gear is slid forward over the key, engaging the gear on the main spindle, and giving the feed with thirteen speeds. By this device a gear blank or piston can be put on each end of the circular milling attachment, and two gangs of cutters on the milling arbor, when the periphery and both sides of two pieces can be milled at the same operation, or, in the case of pistons, the face, the two sides and the packing ring seats can be done two at a time.

In boring with this machine the work is held rigidly, and the drill or boring tool travels to the piece, by the internal sliding spindle, and the drill is guided by the drill jig pendant, in which a suitable bush is placed, insuring accurate drilling or boring from the smallest holes up to 10″ cylinders.

Fig. 2 shows the universal head of this machine as arranged for drilling a jig or any piece of work which may be clamped to the face plate by means of the T-slots shown, and can then be placed at any angle in either a vertical or horizontal plane, the former by means of the graduated arcs shown, and the latter by means of the usual indexing arrangements. Thus any number of holes may be drilled which may have any desired relation one to the other, or milling cuts may be taken in any desired position. The centers of the face plate to which the work is attached, and of the quadrants at either side, intersect, no cross-shaft being used, but the bearing in lieu of it being provided in the quadrants themselves. This attachment, with its various movements, and in connection with the micrometer gradations on the various screws by which the platen is moved in any desired direction, constitute what may well be termed a universal drilling jig.

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LETTERS FROM PRACTICAL MEN.

Vacuum Chamber in Pump Suction Pipe—The Ideal Shop.

Editor American Machinist :

Mr. Gustafson is quite correct in his criticism of my vacuum chamber. Perhaps I ought rather to call it an air chamber in which some of the air coming from the water would collect and form a spring or a vacuum *less perfect* than that below the pump bucket.

What I wanted to show was the advantage of allowing the water drawn from a tube well up by a single-acting pump to rise and fall in its level, all that water above the lowest level accumulating during the down stroke to be absorbed on the up stroke.

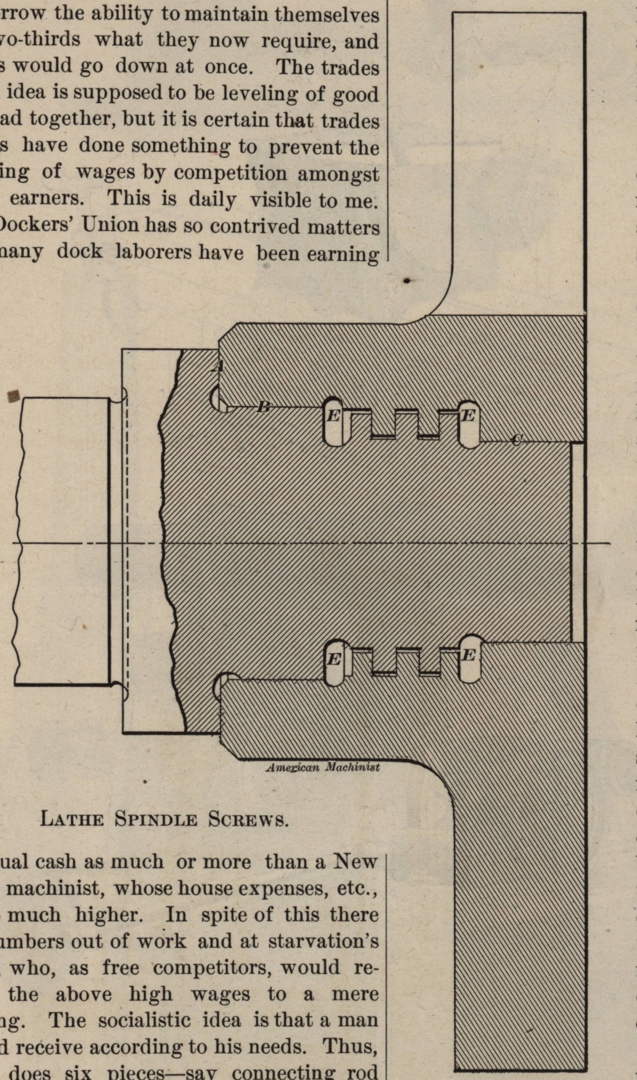
If the pump is direct on the bore pipe without elastic connection, the whole rising column is apt to be checked at every down stroke, and requires to be again set in motion every up stroke. This checking of flow is not all wasted as shock, for is it not recognized by practical men that numerous cases do exist where a pump throws more water than calculation of displacement allows possible? When this occurs it implies a continuance of flow to the pump during the return stroke, the column of moving water passing on through both the bottom check and bucket as this latter returns. Under favorable conditions this happens, and is not difficult to understand.

Mr. Gustafson's gas pipe screwed into the suction will have an identical effect with the "vacuum" chamber. Multiple barrel pumps, of course, obviate the necessity for any such devices.

I am glad to see Mr. Colvin has taken up the ideal shop. While he cannot agree with some of the ideas I put out, he uses one or two arguments against them which do not fit the case: For example, in the case of a contract to be filled, and a man feeling indisposed to work. Unless sick, no man of the stamp I intended could feel indisposed when there was special urgency. I fear, however, that discussion on this subject is premature at the present day. There is too little honesty in either employers or employed to make it practicable as a general thing, but I do not see why it could not be tried in isolated peculiar cases. "Peradventure there be ten righteous men," etc.

As to piece-work, we all know how it finally fails from greed, and I have been informed by an American engineer on this side that on a certain class of work the piece-work rates here were actually higher per piece than in America, and yet the men were only making a little over half the money. In other words, they made a nice living, which was all that the American workmen were making in America at the same rate per piece, but doing twice the number. The Englishmen could have done double work if they had liked, but knew quite well had they done so that the rates would have gradually been cut down, and finally they would have been working as hard as if they had been in America, and would still only have been getting a living. Who can blame workers for getting along as smoothly as possible, when they know that, work soft or hard, they will only earn a living?

The worker who gets out of the general class of workers does so not because he saves his surplus wages, but because he has the ability of getting along on less money than the general crowd. Given to all workmen to-morrow the ability to maintain themselves for two-thirds what they now require, and wages would go down at once. The trades union idea is supposed to be leveling of good and bad together, but it is certain that trades unions have done something to prevent the lowering of wages by competition amongst wage earners. This is daily visible to me. The Dockers' Union has so contrived matters that many dock laborers have been earning in actual cash as much or more than a New York machinist, whose house expenses, etc., are so much higher. In spite of this there are numbers out of work and at starvation's point, who, as free competitors, would reduce the above high wages to a mere nothing. The socialistic idea is that a man should receive according to his needs. Thus, if A. does six pieces—say connecting rod ends—in a certain time, and B. only does five, and yet each of them has gone home in the evening equally fatigued, they would obtain equal money. As things are now regulated, A., who is the better man, gets a fair living; B., who is weakly and requires a better diet than A., actually gets less. In a short time B. only finishes four and a half ends to A.'s six, and then he drops to three, and so on; he obtains less and less money, goes short of food, falls ill, and gets sacked. If he is a fool he turns tramp with his family, but if he recollects that he has paid his rates, he goes to the workhouse like a sensible man, and, being too sick to work, patters about the garden and studies botany—his hobby, perhaps—whilst A., who laughed at his shortcomings in the connecting rod line, has now the pleasure of contributing to support him. In the meantime a better man than A. has arrived, and, being specially gifted on rod ends, offers to do them for less than current rates, and engages to have all he can do for six months. A. finds himself at last earning less than formerly, and still helping to keep B. in idleness, and the last end of that man is worse than the first.



Lathe Spindle Screws.

The unfettered competition of the individualist can only end thus. It is sheer nonsense to state that machinery does not displace labor. True, machinery has often increased the labor employed in certain directions for limited periods of time, but only certain machinery has done this. The sewing machine rendered possible innumerable flounces and furbelows in woman's attire, and did not, therefore, reduce the number of sewers, but machinery applied to such industries as nail making, hitherto handmade, reduced the nail makers to poverty.

Much of the effect of machinery is concealed by reason of production being cheapened.

We waste nails, pins, pens, and numerous small manufactured articles, just because they are cheap. No one spends much time in straightening a steel pen, and yet a gold pen is cared for if damaged, because no amount of machinery can reduce the price of a gold pen very far.

The world being comparatively empty yet, and congestion of population having an outlet in new countries, we have not yet awakened to the fact that it is folly to work ourselves, when a machine of iron will do it for us. True, we have ceased to turn spinning machinery or looms, but we grind away at something for ten or twelve hours daily, and when any one talks of an eight hours' day he is considered revolutionary, and all that. At the same time, when on the subject of an eight hours' day, there is no reason why machinery need only run eight hours. It could just as well run twelve, under two or three sets of attendants.

Only those of us who live in big cities can appreciate Mr. Colvin's remarks about lateness. It is a little hard on a man to expect him to arrive half an hour too soon every morning, because on one or two mornings out of ten he may be five or ten minutes behind. In this city, men have to travel six to ten miles to work, and cannot always be on time.

My boys at school require to travel seven miles every morning. The rule is that no boy is to be considered late who has left his home by 8 A. M.

Employers who stickle so for morning punctuality in starting, will be heard strongly abusive of the men who drop their tools as soon as the evening bell makes them red-hot.

To manage men properly, one requires to know the man's nature, and arrange work accordingly.

One of the best men I have to do with—steady, reliable and accurate—has only one pace; this he sticks to, and it would be folly to put such a man on a job to be rushed through, for he couldn't rush it. As it is, he will keep constantly pegging away at his own pace, and, never making a slip, gets through a lot of work. Another man, who could do double his work at a short push, gets disheartened and nervous when delays occur, and yet both men are men one would be sorry to lose. I would as soon attempt to tie some men to hard and fast rules as I would to tie myself.

As to interfering with whistling in the shop, I would sooner have a shopful of cockatoos, like the forecastle of an Australian steamer, than one of those mournful dens one sees with the "Rules and Regulations to be observed by all who work in this establishment," which same rules are often in direct contravention of imperial law, and wouldn't stand in any court.

London, Eng. W. H. Booth.

"Lathe Spindle Screws."

Editor American Machinist:

Your issue of Jan. 29th, page 7, has an article by "Bell Crank," on "Lathe Spindle Screws," referring to the screw on the spindle of a lathe on which the face plates are screwed, the discussion relating to some method of putting on face plates, so that they may run perfectly true, both on the face and the edges.

In the construction of watch tools this has been a serious problem, and many attempts have been made to accomplish it, but none any more successful than the one which is shown by the accompanying sketch, which I have used many times with perfect success, the theory being that there should be as many surfaces perfectly true as possible, and that the thread should be of such a character as not to affect the position of the face plate.

In this plan, we have first the shoulder of the lathe spindle; second, the outer end of spindle; third, the spindle at the shoulder. In this sketch you will observe that the diameter *C* of the spindle is below the bottom of the thread, and the diameter *B* is above the top of the thread: The threads are square, as V threads would affect the truth of the face plate, but do not touch at either top or bottom, the function of this thread being to screw the face plate against the shoulder *A* of the spindle. After the spindle is hardened, the diameters *C* and *B* and face *A* are ground true, while the spindle is running in its bearings. The recesses at *E* are made for the purpose of removing the corner, and allowing the emery wheel which does the grinding to traverse across the entire face. After cutting the thread in the face plate, and before removing it from the chuck, the parts which fit *B* and *C* are ground true, and to a perfect fit of the spindle.

We have made as many as ten chucks fitting upon one spindle, the chucks projecting 1″ from the end of the spindle, and the result has been absolute truth. We do not anticipate that any lathe makers will resort to this expensive method, but wherever there is a necessity for a face plate running true, we know of no better way.

A. Webster.

Not a Victim.

Editor American Machinist:

I have seen the letter signed "Victim," in your issue of Feb. 26th., and from the position assumed by the writer, and the airs he puts on, I have, after a careful study of the letter, concluded that the signature very justly and truly applies to, and should be considered a part of the last paragraph of the letter, and we will just cut off that brilliant assertion, which has no proof, and consider what precedes it, in a neighborly way, and trust we may have an expression of opinion from many mechanics, on the same subject.

"Victim" makes few positive assertions, but states most of his views negatively, and throws out many innuendoes, leaving the reader to infer many things which he does not positively assert.

I have for many years flattered myself that I was one of them, *i. e.*, a "born mechanic," who had a little of very common school education, acquired before eleven years of age, and up to that age not suspected of the possession of any mechanical ability, but was an expert with a jack-knife.

At the age of twelve I one day saw a millwright trying to lock three pieces of timber together to form the six arms of a wheel, and he was unable to lay out the several pieces, and thinking I could do it, I tried it, and succeeded in doing it correctly at the first attempt, although I had never seen such a job in my life before, and the knowledge necessary to do that bit of work must have been native.

I have employed mechanics nearly all my life since the age of 21 years, and have trained personally more than a hundred apprentices in four different trades, and at least eight are to-day at the head of establishments or departments of large concerns. I have contracted for mechanical work to the amount of millions of dollars, much of which was work in which I had no training, further than to observe what others were doing, and how they did it, much of which was of a special character such as few men would undertake, and more than once have made a foreman of a young man under 21 years of age in charge of works of construction where sums ranging from $20,000 to $50,000 were involved, and have obtained good work, and *made money* right along.

My experience, covering a long term of years, has firmly convinced me there never was a mechanic who was not a "born mechanic," and that mechanical ability is unlike greatness—if a man is not born mechanical he cannot acquire the ability, nor have it thrust upon him, any more than a person not having an ear for music can acquire it.

While I believe the mechanics of to-day are as a class by far the most important of any in the world, yet I give to God the glory of having made them all, although they may have been cultivated in schools and by practice.

Again, while I firmly believe no one not born with mechanical ability, and a taste for mechanical pursuits, can ever learn or acquire such knowledge as will make them successful mechanics, I at the same time as firmly believe that a boy having the taste and inclinations of a true mechanic will indicate the same in precisely the ways which Victim holds up in derision—by making wooden windmills, water wheels, wagons, sleds, playhouses, chicken coops, etc., or will improvise a locomotive and train of cars, or will be found during the school holidays, hanging around some engine-room courting the engineer, or begging waste bits of material at the shops, to use in his own enterprises, in contradistinction to those boys who on a holiday are out playing ball, or frequenting livery stables, making a little garden, boating, or at other amusements, which indicate tastes other than mechanical.

I fully believe "the child is the father of the man," and many times when a boy has applied to me for an opportunity to learn a trade, I have been to his home, and hunted his playground, to see what he has attempted to do, and what he had accomplished, and no amount of after observation would ever give me a better idea of his capabilities. The boy who can "make things" accurately and nicely with a jack-knife can use other tools equally well.

Among the things to be remembered in connection with this subject are these facts:

Many excellent mechanics cannot impart to another the knowledge and skill they possess, hence they are worthless as foremen or bosses, while another man who is an ordinary workman may be able to manage a gang successfully.

Again, many a good workman who can build a piece of work of intricate construction can make no intelligible drawings of his work, while another may make good drawings, if making copies, or working under another's immediate direction, without having any knowledge of the thing he is picturing.

Again, many good mechanics who are good draftsmen cannot do off-hand or perspective drawing at all, and cannot learn.

It is also a fact that many draftsmen, as well as those who are skilled in off-hand drawing, and including some artists of wide reputation, cannot make good letters nor write fairly well, nor can they learn.

Why? The faculties of executing with tools, mechanical drawing, off-hand perspective, making printed letters, writing, spelling, mathematics, teaching or imparting information, are all such as must be born in the man, and while these traits may be cultivated, yet the fact stands patent to every observer that some persons with little or no cultivation will greatly excel others who put forth long and strong efforts to accomplish the same thing, but with only moderate success.

Now, Mr. Editor, I have stated my "beliefs" concerning some things, as being directly adverse to "Victim," and I will add that I think it essential that a man should have some knowledge of a subject in order to write fairly concerning it, and hope for the encouragement of the boys that others will "put in their oar" in this discussion, until it may be satisfactorily determined whether the great mass of skilled workmen of the present day are, or are not, entitled to be individually designated

A Born Mechanic.

Allowable Limit of Pressure on Pivots.

Editor American Machinist:

In your issue of February 5, Mr. Lane gives a few authorities on the limit of pressure allowable on pivot bearings. He fixes the limit at 240 pounds per square inch of area. Now, my experience of over fifteen years in building rubbing wheels for sand-rubbing marble and stone slabs or blocks, has led me to allow 3,000 pounds per square inch, which is just twelve and a half times the limit given by Fairbairn. In a few instances I have seen some machines running with a pressure as high as 4,000 pounds, and they run well, but 3,000 pounds is a perfectly safe working pressure, as can be seen in almost every marble or stone works which has these wheels.

Mr. Lane has good reason to doubt the axiom advanced by Haswell, that "the friction of pivots is independent of the velocity," because when we increase the speed of these wheels as much as 25 per cent. the step heats, and sometimes destroys itself in a short time. I hope that some of your readers having experience in heavy machinery running on pivots will give us some of their notes on pressure limit.

J. H. Frenier.

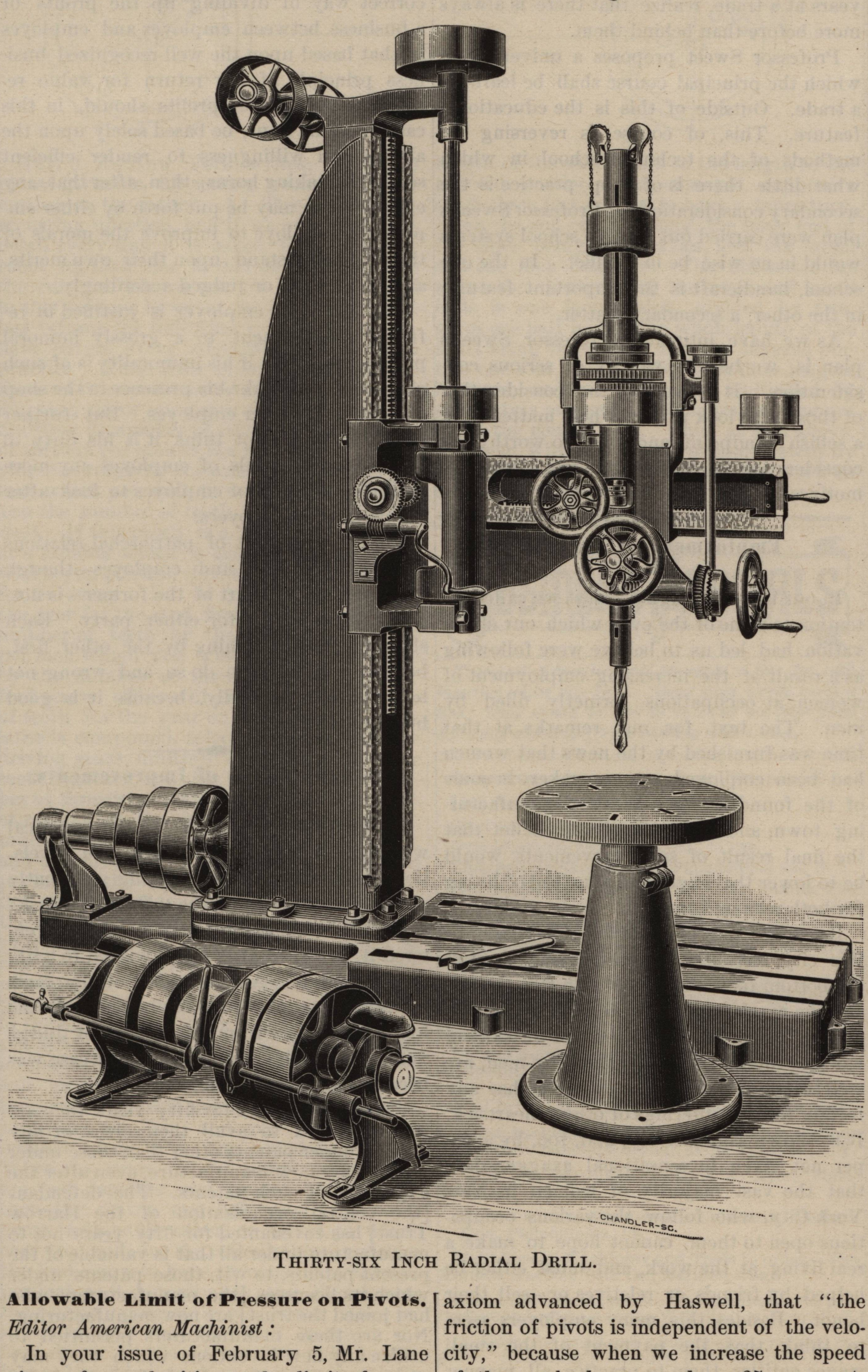
Thirty-six-inch Radial Drill.

The accompanying engraving shows an improved post radial drill built by C. H. Baush & Sons, Holyoke, Mass.

As will be seen, the machine consists essentially of a heavy bed-plate to which an upright is attached, a saddle being fitted to the face of this upright upon flat bearing surfaces at right angles to each other, and fitted with gibs. In the middle of the face of the column is a rack, connected with which is the worm gearing by which the saddle is moved up or down upon the arm. To this saddle is pivoted the arm upon which the drill head moves in the ordinary manner. The method of driving will be understood from an inspection of the engraving, and it will be noticed that the back gearing is located at the spindle, so that there is the least possible trouble from severe torsional stress.

All movements of the spindle, head, and arm are convenient to the operator; the spindle is balanced as shown, so that the weight which balances it moves in line with the spindle and preserves a uniform balance; the arm and the head may be readily clamped in position when desired; there is a quick return to the spindle, and all feeds are positive, there being interlocking clutches, as shown, which are engaged by means of the star wheels, and when released are held apart by spiral springs.

The bed-plate of the machine is 7′ 6′ x 2′ 7″ and 5¼″ deep; extreme height of machine, 10 feet; greatest distance from end of spindle to bed-plate, 5′ 3″; drills to the center of a circle 6′ 4″ diameter. The driving belt on the countershaft is 4″ wide, and that on the machine itself, 3½″; the shipping weight, 5,000 pounds.


CHANDLER-SC.

Thirty-six Inch Radial Drill.

A New Clamping Collar.

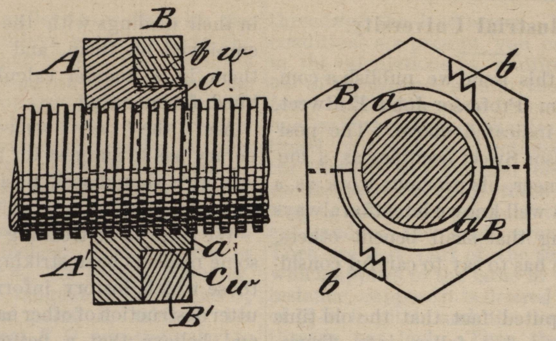


Fig. 2.

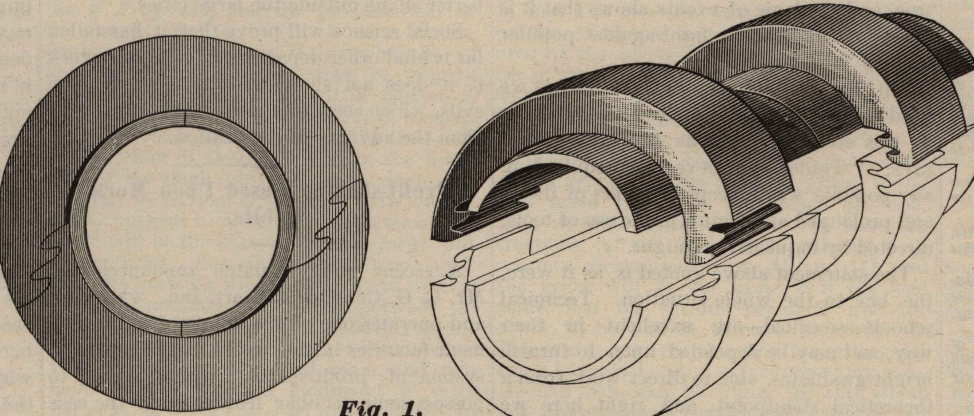


Fig. 1.

A New Clamping Collar.

The accompanying illustrations give an idea of the principle of construction of a clamping collar or ring, for which Mr. Robert King, of 812 Hicks street, Brooklyn, N. Y., has recently been granted letters patent. As will be perceived by reference to the engravings, the collar is made in two parts, so that it can be passed over a shaft, pipe or other cylindrical body at any point where the ends are inaccessible, and are so made as to lock together by the engaging teeth shown.

The inside surfaces of these parts of the collar are so shaped as to be eccentric to each other, and inside of them is placed two pieces, which are in effect simply wedges, which, instead of being straight, are bent to conform to the circle of the shaft, and of the clamping rings. These inside pieces being put in place, and the clamping rings put over them (the teeth being engaged by a sidewise movement), the ring is then turned in the direction to tighten it, and by the wedging action the whole is very firmly secured in position, as we can say from an inspection of some of the rings thus made. Fig. 1 shows the device as intended to apply to a shaft or pipe, and in this form may be used for securing pulleys, thrust collars, etc., or, by using a soft metal for the inside pieces, it has been used with great success for the purpose of stopping leaks in pipes.

Fig. 2 shows the principle applied to a nut, which can be placed over the screw at any point, clamped together and used in the ordinary manner, and can be as readily removed when it is desired to do so. The parts are either cast ready for use of soft metal, malleable iron, steel, etc., or it may be made of any suitable material, and finished by machining, the method of manufacture being, of course, dependent upon the particular use to which the collars are to be put. For securing insulation to the coverings of electric wires or cables, for instance, they are preferably made of a soft metal cast in metallic dies ready for use without further finishing, and may, in this instance, be made either in the form shown, or with a solid outer ring, which may be passed over the tube before it is put in place, and clamped in position after the insulation is in place. It will of course be obvious that the device in various forms can be used for many other purposes besides those mentioned.

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"An Industrial University."

Elsewhere in this issue we publish a communication from Professor John E. Sweet, on the subject indicated above. The position that Professor Sweet occupies as a mechanic and engineer, his previous work as a teacher, and his well-known intention always to do something that shall benefit others, entitles what he has to say to careful consideration.

It is an undisputed fact that the old-time apprentice system has fallen into disuse. However much we may deplore this, it is true, and the logic of events shows that it is useless to maintain a fight against popular opinion in this respect.

But that does not change the fact that we need skilled mechanics, trained in the ways of this country. And, as Professor Sweet says: "Trades can never be acquired in any possible way except by years of direct and prolonged application in the use of tools, directed by inquisitive thought."

The statement above quoted is, as it were, the key to the whole situation. Technical schools—so called—are excellent in their way, and may be depended upon to furnish bright graduates, able to direct work from a theoretical standpoint; and right here we wish to disclaim any intention to make light of this ability. But what is wanted is men who are able to do the work. An army of generals would make a poor job of waging war; so a shopful of men who could simply think out the problems of machinery would never build many machines. Back of the men who think out plans must be the men who can do. There is where men go astray. Popular opinion is to the effect that the skill required in the actual work of manufacture is of but little consequence; yet intelligent mechanics, men who have worked twenty years at a trade, realize that there is always more before than behind them.

Professor Sweet proposes a university in which the principal course shall be learning a trade. Outside of this is the educational feature. This, of course, is reversing the methods of the technical school, in which what little there is of shop practice is the secondary consideration. If Professor Sweet's plan were carried out the two school systems would in no wise be in conflict. In the one school, handicraft is the important feature; in the other, a secondary matter.

As we have intimated, Professor Sweet's plan is, we believe, worthy of serious consideration. It is worthy the consideration of those who look at the whole matter from a selfish standpoint, and it is also worthy the consideration of those who, from unselfish motives, seek to make the world better.

Employment of Women.

In our issue of August 28 last we called attention to some of the evils which our observation had led us to believe were following as a result of the increasing employment of women at occupations formerly filled by men. The text for our remarks at that time was furnished by the news that women had been employed as core makers in some of the foundries of a Western manufacturing town, and we declared our belief that the final result of such movements would be to lower the wages and standard of living for both men and women.

Recently, the *Commercial Advertiser*, of this city, has been at great pains to get at the bottom facts connected with this matter, and the revelations made regarding the condition of some of the women and girls doing work in this city formerly done by men, are well calculated to make him who has any feeling for the sufferings of others, heartsick. It is shown conclusively, and, too, by a paper not given to sensational exaggeration, that the vast majority of women in New York City, who follow the various occupations open to them, cannot hope to make a real living at the work, and must either be helped by friends or relatives or—sell their honor. Besides this, many employers seem to think that the payment of the small wages entitles them to practice all manner of contemptible trickery and mean tyranny in their dealings with the women and girls employed by them, and accordingly treat them in a manner calculated to make one blush for mankind.

And the only remedy our contemporary has to suggest for this, is that American girls should seek positions as household servants.

We seem to be treading paths now that in some respects bear striking resemblances to those which history informs us led to the utter destruction of other nations, but we hope and believe that a better fate awaits us. And, of course, things are as yet in much better shape outside the large cities.

Social science will prove that it has fallen far behind other departments of human work if it does not show the way to avoid these evils, which seem to almost inevitably result from the advance of civilization.

Profit-sharing Based Upon Moral Habits.

A recent press dispatch announces that Mr. C. G. Conn, of Elkhart, Ind., who owns and operates one of the largest band instrument factories in the world, has organized a system of profit-sharing which seems to possess some peculiar features. If the case is correctly reported, Mr. Conn's employes are to be divided into three classes, the first two classifications being based upon length of time of service, faithfulness and morality, while the third class of employes is to consist of those who have been faithful, industrious, etc., but whose habits are not moral.

We have several times tried to point out that schemes of profit-sharing to be successful should be based upon purely business principles; not upon sentiment. Mr. Conn's motives are no doubt good ones, and are entitled to respect, but we think that the only correct way of dividing up the profits of a business between employer and employes is that based upon the well-recognized business principle of fair return for value received. Division of profits should, in this case, it seems to us, be based solely upon the ability and willingness to render efficient service in making horns; then, after that, any efforts which may be put forth by either employer or employe to improve the morals of the other may stand upon their own merits, and be received or judged accordingly.

We believe an employer is justified in refusing employment to a grossly immoral person, especially if his immorality is of such character as to make his presence in the shop an offense to other employes. But further than this we do not think it is his duty to look after the morals of employes any more than it is the duty of employes to look after the morals of employers.

The establishment of patriarchal relations between employers and employes—though creditable to the heart of the former—is not, we think, desirable for either party. Each should do the fair thing by the other, first, because it is right to do so, and wrong not to do it, and, secondly, because it is good business, and pays.

The Suppression of Improvements.

An instructive example of the practical workings of trusts is given by the revelations made in the courts during a recently concluded suit between the "Harrow Trust" and a firm of manufacturers which had entered it, and then afterwards wished to withdraw from it. A good idea of the facts brought out at the trial may be had from the following extract from the decision of Judge Smith, of Elmira, before whom the case was tried. We quote as follows:

"By this contract for fifty years they are not permitted to avail themselves of any devices under patents other than those under which they now manufacture, even after the expiration of such patents. The defendant [the central organization of the Harrow Trust] has covenanted for fifty years not to manufacture under all that is valuable of the present patents, to wit, those patents under which its licensees [the manufacturers who had joined the trust] are now manufacturing. Nor are these manufacturers permitted to utilize any new inventions which they may make or any new patents of which they may acquire control."

It will readily be seen that if this contract had run the length of time intended (fifty years) it would have effectually prevented any advance or improvement in harrows during that time, and this would not only have been prejudicial to the interests of farmers, and consequently of the great mass of people who are not farmers, but harrow manufacturers would not within that time be in the market to any great extent for new machinery or tools to be used in manufacturing. For it is the constant changing, which, with competition, is always going on in the method of manufacture of such things, caused by improvements in their construction, that, more than anything else, perhaps, makes the demand for improved machinery to be used in manufacturing. Here is a case in which not only the natural effect of trusts in repressing improvements was to be put in play, but all improvements were expressly forbidden for a term of fifty years. The decision of the court, and the revelations made during the trial of the case, may lead to the dissolution of the trust, as the publicity given the business, it is thought, will prove exceedingly damaging to the trust and its members. The Clipper Chilled Plow Company, which, it is reported, only consented to join the trust under pressure of threats of ruination of its business, wanted to draw out after a month's experience, and the trust undertook to retain the valuable patents belonging to the Clipper Company. The decision not only gives the Clipper Company its patents, but declares the trust to be an illegal organization, notwithstanding that it is a regularly incorporated company.

◆

A typical illustration of the way in which things are done nowadays was seen in this city a short time ago, in the method adopted for the launching of a new daily paper, *The Recorder*. The full force of editors, reporters, and others in all departments were not only engaged, but put at actual work turning out genuine newspapers for several days, which were not shown to the public, but only to the editor and the publisher. News telegrams came in from all parts of the world, were edited and put in type; local news was carefully gathered and prepared for insertion, editorials were written, the paper was set up, stereotyped and printed as though everything depended upon its being just right, and exactly on time. It is said that before the public saw the first regular issue of the paper $300,000 had been expended upon it. The modern metropolitan newspaper office is a machine which must work smoothly, or there is trouble, and the method adopted by this latest venture in the field of journalism—though a new one in that line—is analogous to the time-honored custom of the machinist, who, when he builds a new machine, usually operates it for a few days, "limbering it up," adjusting a journal here, or a screw there, until everything works smoothly. The incident also shows the difference between starting newspapers now and in the days of Horace Greeley and the elder Bennett.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(118) "New Bedford" asks: Will you give a rule for finding the diameter of round blanks of sheet metal to be drawn by a press into a cup or dish? I want to draw up two cups to be 2¼″ outside diameter, and 2½″ deep, the bottom of one to be flat and with sharp corners, the other with rounded corners. The metal is German silver, and is not to be drawn thinner. *A.*—Mr. Oberlin Smith, in an address delivered before the Franklin Institute, which was published in the *Journal* of Nov., 1886, gave three methods of finding the size of blanks. The first was what he called the tentative method,

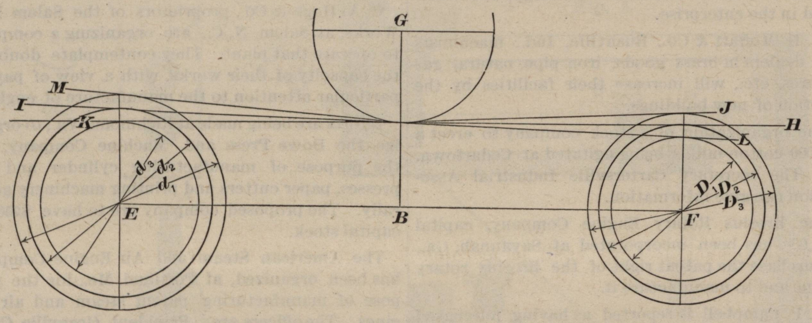
and consisted simply in a series of experiments with various blanks, until the proper one was found. This, of course, was for use mainly in complicated cases, and when the cutting portions of the die and punch could be finally sized after the other work was done. The second method was by weighing the sample piece, and then, knowing the weight of the sheet metal per square inch, compute the diameter of a piece having the required area to equal the sample in weight. The third method is by computation, and the formula given is

$$x = \sqrt{d^2 + 4\,d\,h}$$

for sharp-cornered cup. Where
x = diam. of blank.
d = diam. of cup.
h = height of cup.
For round-cornered cup where the corner is small, say radius of corner less than $\frac{1}{4}$ height of cup, the formula given is
$x = (\sqrt{d^2 + 4\,d\,h}) - r$ about; r being the radius of the corner. This is based upon the assumption that the thickness of the metal is not to be altered by the drawing operation. Applying the first formula to your cup with square corner, we have
$x = \sqrt{2.25'' \times 2.25'' + 4 \times 2.25'' \times 2.5''} = 5.25''$ = diameter of blank. You do not give the radius of the corners of the round-cornered cup, but assuming it to be $\frac{1}{4}''$, and applying the second formula, we have
$x = (\sqrt{2.25'' \times 2.25'' + 4 \times 2.25'' \times 2.5''}) - .25'' = 5''$ = diameter of blank.

(119) J. W. F., Brooklyn, N. Y., writes: Please state the difference between cast-iron and wrought-iron. Although an iron maker, when I was asked the question I could not answer it intelligently. *A.*—Cast-iron is the crude metal derived from the smelting furnace. The ore and fuel are thrown in the furnace together, an intense heat is generated by means of a strong blast of air, the refractory ore is thereby reduced, and the iron gradually melts and runs down to the bottom by gravity. During this preliminary smelting process, the cast or liquid iron has ample opportunity of combining with and absorbing a considerable quantity of carbon; this absorption of carbon in cast-iron, whether in combination with the iron or not, is its distinguishing feature, and determines its behavior in most respects. It is the presence of carbon which gives to it its fusibility, and enables it to be remelted again and again, and thus renders it suitable for the founder, the degree of fusibility depending on the quantity of carbon which it contains. When iron contains carbon in great excess, a portion of it may be in an uncombined condition, and this influences the quality in direction of fluidity, softness and weakness. The proportion of carbon in cast-iron varies from 5 to 2 per cent. Wrought-iron is made directly from cast-iron by a process of elimination, whereby the greater portion of its carbon, as well as any sulphur, silicon, phosphorus, and other impurities are got rid of as far as may be practicable, the change being effected by subjecting the iron, while in a hot or liquid state, to the oxidizing influence of a powerful flame, by which the impurities, as well as the carbon, are carried away in the form of gas, or combine with the slag in the furnace. When cast-iron is thus acted upon by an oxidizing flame, and every part is exposed to its influence in the puddling process, the newly converted mass of viscous iron, when removed from the furnace, may be compared to a dirty iron sponge full of impurities; the doughy mass has to be put under a steam hammer, or some form of squeezer, in order to drive or wring out the mechanical impurities which it contains. It is then elongated, by means of rolls, into a rough bar, and cut into short pieces; these pieces are piled up into a bundle, which is reheated to the welding point, and again rolled, so as to cleanse the iron thoroughly. Indeed, for the better descriptions of wrought-iron, the processes of piling, reheating and rolling are sometimes repeated several times, until the proper quality is attained. The quality of wrought-iron thus treated depends to a great extent on the original selection of the mixture of cast-iron from which it has been made, as well as on the purity of the fuel used for the converting process. By whatever process the change from cast-iron into wrought-iron is effected, the decided alteration of the whole character for the better is unmistakable; the ultimate tensile strength and the limit of elasticity is much increased, by the elimination of carbon and other impurities. Wrought-iron is found to differ almost as much in quality as cast-iron, and this is partly due to the fact that it is seldom or ever entirely free from carbon and other ingredients. The amount of carbon varies from an imperceptibly small quantity up to $\frac{1}{2}$ per cent. The presence of a small quantity of carbon, while serving to increase the strength, rigidity and hardness of the material, at the same time greatly interferes with the welding property.

(120) C. H. S., Munroe Falls, Ohio, writes: We have three pulleys, $31\frac{3}{4}$, $27\frac{5}{8}$ and 24 inches diameter, which we are going to use for cone speeds; and we have also another 32-inch pulley, which is to work with the $27\frac{5}{8}$-inch pulley. What should be the diameters of the other pulleys to work with the $31\frac{3}{4}$ and 24-inch pulleys so as to have the same tension in belt? *A.*—The required diameters will depend on the distance between the centers of the shafts, which you have not given. Hence we shall explain how you can find these diameters for any distance between shafts. Lay off the distance between centers E and F of the shafts. From the center F describe circles D_1, D_2 and D_3, whose diameters are respectively equal to 24, $27\frac{5}{8}$ and $31\frac{3}{4}$ inches. From the center E describe a circle d_2, 32 inches diameter. Draw the line $H\,I$ tangent to the circles d_2 and D_2. From the point B, midway between E and F erect $B\,G$ perpendicular to $E\,F$. Locate the point G by making $B\,G = E\,F \times .314$; that is, multiply the center line $E\,F$ by .314, and the product will be the height of $B\,G$. With G as a center, draw a circle tangent to $H\,I$; the belt line of any other pair of pulleys must be tangent to the circle G; hence draw $J\,K$ tangent to the circles G and D_3, and from E as a center draw the circle d_3 tangent to the line $J\,K$; the diameter of this circle will be the diameter of the small pulley. Lastly draw $L\,M$ tangent to D_1 and G; from E draw the circle d_1 tangent to $L\,M$; the diameter of this circle will be the diameter of the large pulley required. In order to obtain great accuracy the drawing should be made to as large a scale as possible. For 8 feet between the centers E and F we find d_3 to be 28 inches, and d_1 36 inches; but these sizes were obtained from a comparatively small scale, and may have to be somewhat modified. 2. What per cent. of saving in fuel can I obtain by using a high-speed automatic cut-off engine, instead of a common slide valve engine, everything else being the same? *A.*—Your question is very indefinite; the saving of fuel will depend much on the kind of engines used; you may obtain, with a good automatic cut-off engine, a saving of 10 to 15 per cent. or more, in fuel.



(121) J. Z., New York, writes: Will you please give rule for setting gears for screw cutting on the lathe? *A.*—This is an ever-recurring question, and if we answered it in detail every time it is asked there would be room for little else in this department. As the rule for this has not yet been published in this volume, however, we reprint from the last volume the following rule, which we believe covers every condition met with in practice. If the lathe is simple geared, and the stud runs at the same speed as the spindle, then select some gear for the screw, and multiply its number of teeth by the number of threads per inch in the lead screw, and divide this result by the number of threads per inch which you wish to cut. This will give you the number of teeth in the gear for the stud. If this result is a fractional number, or a number which is not among the gears which you possess, then try some other gear for the screw. But if you prefer to select the gear for the stud first, then multiply its number of teeth by the number of threads per inch which you wish to cut, and divide by the number of threads per inch on the lead screw. This will give you the number of teeth for the gear on the screw. If the lathe is compound, select at random all the driving gears, multiply the numbers of their teeth together, and this product by the number of threads you wish to cut. Then select at random all the driven gears except one; multiply the numbers of their teeth together, and this product by the number of threads per inch in the lead screw. Now divide the first result by the second, and you will have the number of teeth in the remaining driven gear. But if you prefer, you can select at random all the driven gears. Multiply the numbers of their teeth together, and this product by the number of threads per inch in the lead screw. Then select at random all the driving gears except one. Multiply the numbers of their teeth together, and this result by the number of threads per inch of the screw you wish to cut. Divide the first result by the last, and you will have the number of teeth in the remaining driver. When the gears on the compounding stud are fast together, and cannot be changed, then the driven one has usually twice as many teeth as the other, or driver, in which case you can, in the calculations, consider the lead screw to have twice as many threads per inch as it actually has, and then ignore the compounding entirely. Some lathes are so constructed that the stud on which the first driver is placed revolves only half as fast as the spindle. You can ignore this in the calculations by doubling the number of threads of the lead screw. If both the last conditions are present, you can ignore them in the calculations by multiplying the number of threads per inch in the lead screw by four. If the thread to be cut is a fractional one, or if the pitch of the lead screw is fractional, or if both are fractional, then reduce the fractions to a common denominator, and use the numerators of these fractions as if they equaled the pitch of the screw to be cut, and of the lead screw respectively. Then use that part of the rule given above which applies to the lathe in question. For instance, suppose it is desired to cut a thread of $\frac{25}{32}$ inch pitch, and the lead screw has 4 threads per inch. Then the pitch of the lead screw will be $\frac{1}{4}$ inch, which is equal to $\frac{8}{32}$ inch. We now have two fractions, $\frac{25}{32}$ and $\frac{8}{32}$, and the two screws will be in the proportion of 25 to 8, and the gears can be figured by the above rule, assuming the number of threads to be cut to be 8 per inch, and those on the lead screw to be 25 per inch. But this latter number may be further modified by conditions named above, such as a reduced speed of the stud, or fixed compound gears. In the instance given, if the lead screw had been $2\frac{1}{2}$ threads per inch, then its pitch being $\frac{4}{10}$ inch, we have the fractions $\frac{4}{10}$ and $\frac{25}{32}$, which, reduced to a common denominator, are $\frac{64}{160}$ and $\frac{125}{160}$, and the gears will be the same as if the lead screw had 125 threads per inch, and the screw to be cut 64 threads per inch. 2. Please also give me the rule for setting for taper in the lathe such as for connecting rods. *A.*—No rule can be given for this which will produce exact results, owing to the fact that the centers enter the work an indefinite distance. If it were not for this circumstance the following would be an exact rule, and it is an approximation as it is. To find the distance to set the center over: Divide the difference in the diameters of the large and small end of the taper by 2, and multiply this quotient by the ratio which the total length of the shaft bears to the length of the tapered portion. For example, suppose a shaft three feet long is to have a taper turned on the end one foot long, the large end of the taper being two inches, and the small end one inch diameter. The difference between the diameters of the large and small ends is one inch, which, divided by two, gives one-half inch. The whole length of the shaft being three feet, and the tapered portion one foot, the ratio between their lengths is three, and one-half inch multiplied by three gives one and a half inches, the amount to set the center over. This, as said above, however, will be modified to some extent by the fact that the centers enter the work an indefinite distance.

BUSINESS SPECIALS

Transient Advertisements 50 *cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.*

Gears, gears, gears, gears, gears. See page 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Ice and Refrigerating Machines, 155 sold, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

Get particulars of our new Wall, Suspended and Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N. Y.

Crank pin Machines. Pedrick & Ayer, Philadelphia, Pa.

Planer Chucks—Greenwood's Universal. Pedrick & Ayer, Philadelphia, Pa.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

I. D. L. Drawing Stands. The original. For particulars and prices, address W. S. Rogers, Troy, N. Y.

Castings for small and medium-sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

To get the best work out of a Star Hack Saw, bear down heavily, and draw it very slowly.

For small boilers address W. D. Rich, 539 Race street, Philadelphia, Pa.

Audubon Machine Works, New Haven, Conn. Electrical work, superior facilities, builders of machinery, heavy and light.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

Billings & Spencer Co.'s Packer & Boiler Ratchet, and all kinds of Forged Wrenches. S. A. Smith, 23 S. Canal St., Chicago, Western representative.

For the latest improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dill Machine Company, Philadelphia, Pa.

Self-adjusting Hand-screw for pattern makers, cabinet makers and wood workers generally; send for circular. Wm. H. Denney, Lancaster, Pa.

25″ "Only Drill Press built on
32″ 'Ko-rekt' principles,
37″ even if they come from Jersey."
42″ Gould & Eberhardt, New Ark, N. J.

DuBois & DuBois, Patent Attys, 715 11th St., Washington, D. C., procure first-class patents. Send stamp for illustrated pamphlet, "March of Invention," containing valuable information, and list of references.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo. cloth, $3. Catalogue of books on mech. subjects free, E. & F. N. Spon, 12 Cortlandt St., New York

Boiler Makers—The advertiser has designed a cylindrical boiler, which combines several new and important points for high pressures and light weights. Wishes to correspond with reputable parties to develop same. Stacy Potts, 1431 R street, N. W., Washington, D. C.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the American Machinist in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address American Machinist, 96 Fulton St., New York.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th St., New York.

MANUFACTURES.

A machine shop will be established at Ocala, Fla.

A cotton factory, to cost $100,000, is to be built at Cheraw, S. C.

Wrought-iron pipe works will probably be established at Roanoke, Va.

Ground will be broken about May 1, for a cotton-mill at Huntersville, N. C.

A hardware factory, to cost $26,700, is to be established at Middleville, Mich.

An electric light plant will, it is reported, be established at Versailles, Ky.

P. B. Allen will, it is reported, establish a tin-working factory at Buchanan, Va.

The El Paso (Tex.) Foundry and Machine Company will erect a building 40x110 feet.

Sioux Falls, Dak., is to have a new machine plant, which it is expected will employ 500 men.

The Smith-Hill Co., Quincy, Ill., will build an addition to their extensive machine shops.

G. L. Colgate has received franchise to erect a $100,000 electric light plant at Roanoke, Va.

It is stated that Berwick (Pa.) Car Works contemplate removing their plant to Bristol, Tenn.

G. Jaeger is investigating with a view of erecting a $15,000 electric light plant at Cuero, Texas.

The organization of a stock company to erect a cotton-mill at Elizabeth City, N. C., is talked of.

The Lead Hill Foundry and Machine Shops, at Lead Hill, Ark., expect to put in new machinery.

The Lyman Mills Corporation, Holyoke, Mass., will erect a new mill, which will cost about $50,000.

The Holt Manufacturing Company has been organized at Hartford, Conn., to manufacture hardware.

The Richmond (Va.) Locomotive and Machine Works is rebuilding its boiler shop, lately burned.

It is stated that final arrangements have been made which secure to Pulaski, Va., a large rolling-mill.

Ground has been broken at Jackson, Mich., for the buildings for the new Columbia Foundry Company.

J. C. Shaw, of Collins, Ohio, is investigating with a view of removing his pump works to Clarksville, Tenn.

The size and capacity of the Berlin Machine Works, at Beloit, Wis., will be doubled the coming spring.

J. A. Hunnicutt and G. T. Johnson will, it is reported, erect the ice factory lately mentioned at Athens, Ga.

The Henrietta Cotton-mills Company, of Henrietta, N. C., will, it is stated, double the capacity of its cotton-mill.

The Belton Iron Works, of Belton, will probably remove its iron foundry and machine shops to Comanche, Texas.

The Chattahoochee Land Company, of Atlanta will, it is reported, build iron furnaces and rolling-mills at Bolton, Ga.

The Mammoth Spring (Ark.) Roller Mills Company will add new machinery to their plant and increase its capacity.

Merwin McKaig, of Cumberland, Md., will, it is reported, remove his iron and steel shafting works to Martinsburg, W. Va.

The Curtis Hardware Company is a new incorporated concern at Wellington, Kansas, with a capital stock of $30,000.

A stock company will be organized to operate the Murray & Stevenson Iron Foundry and Machine Shops, at Anniston, Ala.

A large machine shop connected with the Duluth, South Shore & Atlantic Railroad is to start up soon at Marquette, Mich.

New machinery will be added to the Arlington (S. C.) cotton mill, and the Calumet cotton factory at Mammoth Spring, Ark.

It is reported that additional machinery will be put into the Altamaha cotton-mills, which are located at Burlington, N. C.

It is stated that a committee will endeavor to organize a $60,000 stock company to erect a rolling-mill at San Antonio, Texas.

The Southern Rolling Mill, at Avondale, Ala., is shortly to increase its capacity by the addition of ten more puddling furnaces.

The new foundry of Doherty Brothers, at Lowell, Mass., will be furnished with machinery to run by electricity, at a cost of $35,000.

It is reported that the Capitol Electric Company, Nashville, Tenn., will put a 1,000 horse-power engine in its electric light plant.

The Hazen Co., of Anderson, Ind., is now erecting an immense nail plant, and contemplates the erection of a steel billet plant.

Work on the new factory of the South Wareham, (Mass.) Nail Works is being pushed rapidly forward. New machines are to be put in.

The Houston (Tex.) Foundry and Machine Company, with a capital of $25,000, has organized to build a foundry and machine shop.

E. H. Bramnel, of Camden, Me., is to build a two-story building, 46x52, for a brass and iron foundry and machine and wood-working shop.

A foundry and machine shop will be established at Berryville, Va. The Berryville Land and Endowment Company can give information.

P. H. Abernathy, of Bakersville, W. J. Graham, of Johnson City, and R. L. Graham are reported as to erect an ice factory in Asheville, N. C.

A cotton factory with a capital of $90,000, to give employment to about 100 operatives, will be erected at Morristown, Tenn., by A. J. Patterson.

W. D. Forbes & Co. are starting a new machine shop at Thirteenth and Hudson streets, Hoboken, N. J., for building special tools, guns, etc.

The Anniston Manufacturing Company, of Anniston, Ala., is reported as to put new machinery in, and increase the capacity of its cotton-mill.

The Seaton Manufacturing Company, of Cleveland, Ohio, is corresponding with a view of removing its bolt and nut factory to Anniston, Ala.

A proposition has been made for the organization of a $350,000 stock company for the purpose of establishing a hardware factory at Roanoke, Va.

The Southern Horse and Mule Shoe Company has recently been organized, with a capital stock of $300,000, to erect machine shops at Strasburg, Va.

It is said that new manufacturing enterprise was never so lively in Texas as at the present time. A good deal of capital is finding its way into the State.

The Old Dominion Iron and Nail Works Company, Richmond, Va., contemplate the early improvement and enlargement of their iron and nail works.

J. B. Hastings, of Parkersburg, W. Va., proposes the organization of a $100,000 stock company, to establish a Hastings wire nail factory in Roanoke, Va.

The Southern Rolling-mill will, it is reported, increase its capacity by the erection of ten additional puddling furnaces at its rolling-mill near Avondale, Ala.

The Bessemer (Ala.) Pipe Works will be in operation by March 1. They will employ 800 men at the beginning, the force to be increased very soon to 1,000.

The bill to incorporate the Alabama Iron and Steel Company, Birmingham, Ala., recently reported, has been introduced in the legislature and passed.

The Kingsley Foundry and Manufacturing Company, of Elyria, O., have secured a location in Hammond, Ind., and will erect on it a plant to cost $30,000

Crews & Westbrooks, Danville, Va., have, it is stated, erected an additional buillding to their iron foundry and machine shops, and put in new machinery.

W. J. Hammond & Sons, of Pittsburgh, will erect a new sheet-mill at Mansfield, Pa., the citizens of that place having donated a twenty-acre site for the works.

W. C. Hargrove, of Sulphur Springs, Tex., is endeavoring to organize a stock company for the purpose of erecting a cotton and woolen-mill at that place.

Messrs. Berger & Raney, of Newcastle, Pa., contemplate, it is stated, the construction of four iron furnaces in Middlesborough, Ky., with a steel plant in connection.

The Chesapeake & Ohio Railroad Co. (office, Richmond, Va.,) is reported as having secured site, and is to erect $250,000 foundry and machine shop at Russell, Ky.

The James Reynolds Machine Company has been organized at New Haven, Conn., to manufacture, buy and sell general and special machinery and machine tools.

R. J. May has sold his foundry and machine shop at McKeesport, Pa., and has purchased another site on which he will erect a much larger plant to cost about $50,000.

The Little Rock Cotton-mills Company has been organized, purchased the Quapa cotton-mill at Little Rock, Ark., and will put new machinery in and operate same.

It is stated that the Bloomsburg Car Company, of Bloomsburg, Pa., have been prospecting at Bristol, Tenn., looking to the establishment of a car works plant in that place.

Messrs. Berger & Raney, of New Castle, Pa., contemplate, it is stated, the construction of four iron furnaces in Middlesborough, Ky., with a steel plant in connection.

The Ohio Development Company, of Florence, Ala., are in negotiation with Ohio capitalists, looking to the establishment at Florence of a rolling-mill and iron works.

A number of Chicago and Pittsburgh capitalists have located a tinplate-mill in South Joliet, Ill. The firm of Lewis Bros., of Pittsburgh, are interested in the enterprise.

W. H. Moffatt & Co., Rushville, Ind., machinists and dealers in brass goods, iron pipe, natural gas fixtures, etc., will increase their facilities by the erection of new buildings.

The organization of a stock company to erect a $50,000 cotton-mill is being agitated at Cedartown, Ga. The secretary Cartersville Industrial Association can give information.

The Brosius Rotary Engine Company, capital $500,000, has been incorporated at Savannah, Ga., to purchase the patent right of the Brosius rotary engine and to manufacture it.

W. P. Campbell is reported as having purchased the Foster Hardware Works, at Florence, Ala., for $47,000, and as organizing a stock company for the purpose of operating the works.

The Albion Iron Works, capital $200,000, has been organized at Knoxville, Tenn., to build a foundry and machine shops. A. L. McEwon, manager, Cincinnati, O., can give information.

The Automatic Station and Street Indicator Company, Rockingham, N. C., are considering the question of a new location. When this is determined they will build a new factory at once.

It is stated that negotiations are pending for the erection of a cotton-mill by Cincinnati (Ohio) parties at Middlesborough, Ky. The Middlesborough Town Company can give information.

Endeavors are now being made for the organization of the $125,000 stock company to erect a cotton-mill at Edgefield, S. C., recently mentioned. For further information address G. B. Lake.

The La Grange Electric Light and Power Company has been incorporated at La Grange, Ky., with I. T. Risley, president, and D. C. McDowell, secretary. The capital stock is $15,000.

It is reported that a $50,000 stock company has been organized to erect a wire nail factory at Salem, Va., to use the patent wire nail machinery of J B. Hastings, of Parkersburg, W. Va.

Oden Bowie, I. F. Rasin, W. J. O'Brien and others have incorporated the Zell Stored Power Co., Baltimore, Md., to manufacture a motor invented by R. R. Zell. The capital stock is $500,000.

Contract has, it is reported, been signed by Chicago (Ill.) and other capitalists for the erection of a $200,000 structural and galvanized iron works, in Pulaski City, Va. L. J. Hyland is interested.

The Chicago & Erie Co. will erect at Huntington, Ind., a building 250 feet long by 75 feet wide, in which to do car repairing. This will increase their force of shop hands at that point about 100 men.

A cotton-mill, to employ a thousand hands, and with a capital of not less than $500,000, is to be erected near Norfolk, Va., by a company of residents of New York, with John G. Hoyt as president.

It is stated that O. Hammond, E. F. Jones and S. H. Moffett, of Harrisonburg, Va., will organize a $1,000,000 stock company at Baltimore, Md., to manufacture the patent cigarette machine of J. V. Bohannon.

The Alabama Locomotive Company, recently reported (under Montgomery), has for its purpose the erection of locomotive works in Alabama City, Ala.; capital stock, $1,000,000, with privilege of increasing to $10,000,000.

The "Hartford Engine and Machine Works" is the title of a new concern at 223 State street, Hartford, Conn. Small steam engines, pumps and other machinery of the kind will be built, including special machines and tools.

The Springfield Emery Wheel Manufacturing Company, Bridgeport, Conn., issue a very complete catalogue of emery and corundum wheels, flint and sapphire paper and emery cloth; also grinding machines in a great variety.

The Wells Manufacturing Company has decided to begin the manufacture of stoves, and will immediately buy a site and erect a large factory in Indianapolis, Ind. The company has arranged to invest $50,000 in the enterprise.

There is water-works agitation in Ballard, Wash.; Keene, N. H.; Salt Lake City, Utah; Prospect, N. Y.; Newberne, N. C.; Spokane Falls, Wash ; Mount Tabor, Ore., Corvallis, Ore.; Stanford, Ky.; Macomb, Ill.; Tacoma, Wash.; Macon, Ga,

S. H. Shadbolt, C. B. Houghton, J. R. Bate and others, have incorporated the Excelsior Machinery Company, Covington, Ky., to manufacture the rotary reciprocating machine, excelsior machinery, etc. The capital stock is $50,000.

The Western Rolling Stock Company, of Chicago, has been incorporated, with a capital stock of $100,000, by George E. Farley, Grant S. Wheeler, and William E. W. Johnson. It will manufacture cars, engines and other rolling stock.

The Canonsburg Iron and Steel Company, of Canonsburg, Pa., has decided to enlarge its capacity. The firm manufactures sheet iron and steel for stamping purposes and galvanizing. The present capacity is about 4,000 tons per year.

The Russell Electric Manufacturing Co. have been organized at Portland, Me., for the purpose of manufacturing all kinds of machinery. The officers are: President, W. G. Chapman, Portland, Me.; Treasurer, C. W. Russell, Providence, R. I.

C. W. Huntington, J. K. How, W. H. Pitcher and others have incorporated at Baltimore, Md., as Huntington, How & Pitcher, for the manufacture and sale of all kinds of electrical machinery and supplies, etc. The capital stock is $35,000.

C. A. Hege & Co., proprietors of the Salem Iron Works, at Salem, N. C., are organizing a company to operate that plant. They contemplate doubling the capacity of their works, with a view of paying particular attention to the manufacture of engines.

Efforts are being made at Richmond, Va., to organize the Dowe Press and Machine Company, for the purpose of manufacturing cylinder and job presses, paper cutters and printing machinery generally. The proposed company are to have $250,000 capital stock.

The American Steam and Air Engine Company has been organized, at Portland, Me., for the purpose of manufacturing patent steam and air engines. The officers are: President, Granville Cash, of Chelsea, Mass.; treasurer, H. M. Bullock, of Franklin, Mass.

The plans for the Missouri, Kansas & Texas Railway shops, to be built at Greenville, Texas, have been completed by Chief Engineer Jarvis. These shops will furnish employment for a large number of men, and will be equal in capacity to any railroad shops in the State.

The New Process Rawhide Company, Syracuse, N. Y., hand us letters from those who are using their rawhide gears, which letters are highly commendatory. These gears seem to possess wearing qualities that commend them to the user, and they run practically noiseless.

The shops of the Ensign Car Company, at Huntington, W. Va., are at work upon an order for 1,000 cars for the Mexican International railway, and several other large orders for western roads. The company will soon commence upon a large addition to the car wheel shops.

The E. Horton & Son Co., of Windsor Locks, Conn., have purchased the iron foundry and buildings of A. W. Converse & Co., which adjoin the Horton Works on the north. This purchase will give them a large water frontage, and allow them to make needed additions to their plant.

It is announced that the Iowa Barb Wire Works will shortly erect an annex to their plant at Allentown, Pa. The addition will be 100x160 feet of brick, and will be built to the west end of the barb mill, which will then be 100x300 feet, making it the largest establishment of its kind in the world.

A joint stock company has been organized at Comanche, Tex., with a paid-up capital of $15,000, for a foundry and machine shops, to be erected in the near future. The stock is all owned by the business men of Comanche. Mr. Ed. S. Wiseman, late of Belton, Tex., is interested in the enterprise.

A corporation, to be known as the Staple Fastening Machine Company, capital stock $100,000, has been organized at Saco, Me., for the purpose of doing a general machinery business. The officers are: President, William S. Hamm, of Newton, Mass.; treasurer, J. Sidney Snow, of Boston, Mass.

A charter of incorporation has been granted by the Government of Ontario to Cant Bros. & Co., of Galt, under the title of The Cant Bros. Co., of Galt, Limited. The company will continue the manufacture of wood-working machinery. The capital stock is $40,000. The president is Andrew Cant, of Buffalo.

An agreement has been entered into between the Ohio River Railroad Co. and the Huntington & Kenova Land and Improvement Co., for the Ohio River road to build shops and roundhouses at Central City, W. Va., a new town laid out between Huntington and Kenova, on the line of the extension of the Ohio River road.

The Grant Locomotive Works are preparing to construct works at Chicago. Plans have been prepared for complete shops, with an annual capacity of 250 locomotives. The plans are so designed that extensions may be made at a minimum expense. Things will be so arranged that economical and rapid production will be the feature.

It is stated that a contract has been entered into with the Union Steel Works, of Louisville, Ky., manufacturers of edge tools, to locate their plant in Lexington, Va., at as early a day as possible. This company have a capital stock of $1,000,000, and the buildings will cover 4 acres of ground. They agree to work 300 skilled laborers.

The president of the Brilliant Iron and Steel Company, at Brilliant, Ohio, has made a proposition to the authorities of that city, that if the council will give the company half of a street close to their present plant, the firm will erect a sheet and bar-mill in addition to the present plant, and thereby make it possible to increase the force of workmen to 500 or more men.

The Stowell Iron Company, Duluth, Minn., has filed articles of incorporation, with a capital stock of $1,000,000, divided into shares of $10 each. The officers and incorporators are: President, W. H. H. Stowell; vice-president, T. H Pressnell; secretary, B. E. Baker; treasurer, A. C. Jamison, and directors, George F. Long, S. F. Boyce, Frank I. Tedford, Jacob Zimmerman and Lannes W. Hizar.

The Standard Iron Works, of Superior, Wis., are making extensive preparations for the enlargement of the foundry and capacity of their shops at Tower Bay slip. The addition to the foundry, work on which has already begun, will be 75x50 feet, of brick and stone, with an iron roof. A new cupola and a brick chimney 60 feet in height will be built, and considerable new and improved machinery added.

The Ingersoll Milling Machine Company, Cleveland, O., have closed contracts for removal of their plant to Rockford, Ill. Strong inducements were presented, and a building is now being erected, 60x150, to be equipped with modern machinery. The present plant at Cleveland has been disposed of to the Cleveland Twist Drill Company, now renting part of the building, and whose business requires more room.

Mr. J. H. Sternbergh, whose extensive nut and bolt works at Reading, Pa., were destroyed by fire three weeks ago, has decided to rebuild at Reading, although tempting offers were made from other towns. The new works will be of a very extensive character. The main building is to be constructed of iron and brick, with roof of corrugated iron; dimensions, 186 by 200 feet; a two-story brick office, 25 by 60 feet, and a two-story brick machine shop, 60 by 80 feet.

With the completion of the two new stacks now in course of erection by the Colorado Coal and Iron Company, at Bessemer, adjoining Pueblo, Colo., this company will have an output each day of 500 tons of pig-iron. The general manager has received instructions to expend $500,000 additional in improving and enlarging the works, so as to increase and cheapen the production of steel rails and merchant bar. Work has already commenced on these improvements.

◆

When there is a proposition for a State to expend money in building a canal, our esteemed railway contemporaries immediately proceed to show how much cheaper it would be to build a railroad. And generally speaking, they are right. But the question is always deeper than this. It isn't what it will cost to provide the means of communication, but what will it cost to use this means?

Men who own a railroad are no different from men who own something else—that is, they will make all the money they can from the ownership. And this is right enough as things go. But away behind this is the fact that what is needed in this world is the means of getting what is produced into the hands of the consumer at the least possible cost. At the best this cost is practically a loss—a loss that grows up from modern civilization.

There is just now a proposition before the State of Pennsylvania to build the Lake Erie and Ohio River Ship Canal. This is a large undertaking; not large for the State of Pennsylvania, but it looks large in round figures—say $30,000,000. But once built, it forever does away, on that route, with monopoly. Freights will be forever thereafter governed by what will pay the individual boat owner. It will be a good thing to build the canal.

◆

The ugliest strikes of workingmen that occur in this country are of men who are not citizens, and who never intend to be citizens. There is no reasonable doubt that the intention is to grind these men down pretty low, and they resent this just about the same as if they were born here.

Conveniences in the Machine Shop.

By A Mechanic.

I will next take up the knee. Fig. 1 shows a cross-section of knee and also a section of drilling jig in position. Fig. 2 shows an end view of this drilling jig with its means of fastening to the top of knee. The drill bushing shown at *B* is for boring for cross-screw, so when the jig is removed the cross-slide can be put on and fastened in place by a temporary gib—with the nut in place—and so make of use this bored hole for a jig to drill the nut. *C C* shows the drill bushings for boring for the cross-shaft to operate the vertical screw. I think the illustration makes this plain.

As far as great accuracy goes in such jig making there need be no apprehension, for if as accurate work is done in making the jig as is done in making the machine without the jig, it is all that is needed. The hubs of bevel gears should always be left long for fitting. The face *A* (Fig. 1) should be planed.

The nut for vertical screw is shown in Fig. 3, and also a screw arbor for locating this. The end *A* of this screw arbor is turned to fit the hole *D* (Fig. 1.) This nut should be squared up on the base true with the thread.

Right here is a little point where in designing we can help the making. Cast lugs in the base of the nut, as is shown at *B*, so a T-headed bolt can be got in to clamp this nut to the base of machine while being drilled on. These lugs can then be broken off. Now if the boss on the base of machine has been planed square, we can set the nut on and then lower the knee (which we will suppose has been fastened to the place by a temporary gib) till the end of screw arbor enters hole *D* in the knee, then clamp the nut to base and drill with tap size drill, afterwards counterboring nut for body size of screw.

I think we have gone far enough now to see the nature of jigs and fixtures for machine shop use. Such jigs are not necessities, but are conveniences, for they save time, and so reduce the cost of production. Such jigs are not expensive, if, in making them, after furnishing the machinist with a drawing of what is wanted, he is shown what work the jig is to be used for, and about what is required of it, then leave him to his judgment to do the job *good enough.* But if, instead, he is only given the drawing, with all the dimensions on it that can be put there, and then if he inquires further is told that the designer knew what he wanted, and put it on the drawing, he is obliged to do a great deal of unnecessary work; if, in this case, the jig costs more than it should, it is easy to see who is to blame.

There are many machine shops where machines from one set of patterns have been made in quite large numbers for years without a jig of any kind. Now this is too slow for the times, and very likely if one of these places would undertake to make jigs, and special fixtures for all their work, so that each part could be made a distinct creation, and so all parts could be finished ready for assembling, without any regard to any other part, they would find they were too quick for the times. There is a dividing line here somewhere.

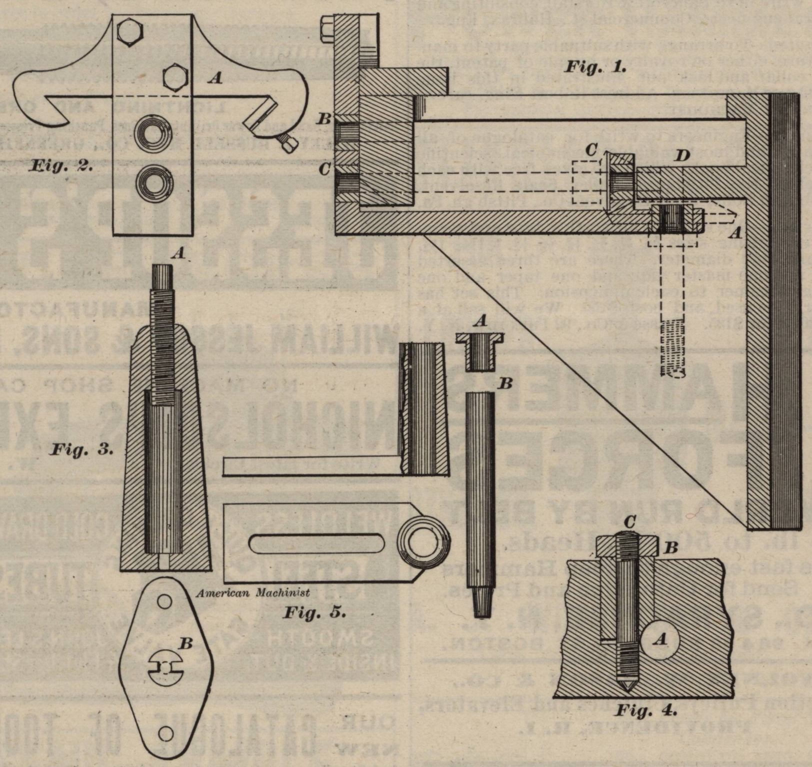
For an illustration, we will suppose, for a shop where general jobbing is done, that the line be a true circle, so that in whatever direction we go we can only go a short distance before we fetch up. But as the shop begins to go into specialties the circle begins to flatten, that is, to extend in one direction and contract in other directions, so that when we have reached the gun factory it is only a dash, and has then almost no limit in that one direction.

Fig. 4 shows a section of a piece broken from the turret head of a screw machine. *A* is one of the holes used for holding tools; *B*, is a sleeve used by some makers for clamping the tools. The stud *C* is a loose fit through this sleeve, but in tapping for this stud without a jig it is necessary to use some care.

A friend of mine, being a new man in the shop, asked the foreman if he had a tapping jig for this. "You don't need a jig for that," was the reply, in a disgusted tone of voice. Their way was to bend these studs after putting in when they did not come right, which was quite often by their way of working. Now a tapping jig here would be a convenience, and would be so cheap that there is a poor excuse for not having it. As far as needing it is concerned, there is no absolute need of any jigs unless it is to make some profit on the machine.

I have often seen machinists, who were interested in their work, drill a piece of scrap for a temporary jig (carefully keeping it out of the sight of the foreman) to do one job with, then throw it back into the scrap-box again. Sometimes one of these little temporary jigs saves ten times as much time as it takes to make it on one job. Would it not be better if this had been made in a little more durable form and kept for that job?

These shops have made iron-bound rules that they can't jig work, for the plan is too expensive. Now an iron-bound rule in this respect is just as sensible as iron-bound rules generally are, that is, they are always plain nonsense. Rules can only apply to one set of conditions. It seems strange that some of these men, who feel perfectly sure that they can devise rules for everything, do not conceive the grand scheme of writing something oracular to govern machinists. Such a book, even if it cost a very high price, would be a good investment for any machine company, for it would save employing a very expensive man. This book could be kept on a tripod in the center of the shop, and all matters to be decided could be referred to it. If there should come up any matter that the oracle did not answer, the owner should sue the author.



Conveniences in the Machine Shop.

Ordinary tapping or reaming jigs, I believe, are not very satisfactory. When a straight, soft hole is used—clear through—to fit the shank of tap or reamer, the lower end of hole soon gets cut out bell-muzzled, and if the hole is a hardened one it soon spoils the tap or reamer. What I propose is the rig shown in Fig. 5.

The body, it will be seen, is the same as usual, except the hole is made larger than the shank of tap or reamer, so that different sizes of bushings (one shown at *A*) can be used only to guide the top of tap or reamer. We can locate this by the use of plugs (one shown at *B*), the body fitting the hole in the jig and the point, tap or reamer size.

This will allow of one jig answering for a number of sizes, and avoid the common destruction of such things. These tapping jigs we will send to the tool-room, for they are general tools, but special jigs and fixtures are better kept on proper shelves in the shop. In a shop where there are many of these special jigs, it is a good plan to stamp a number on each, and also have a paper tag pasted on the shelf in front of where that jig is to be kept. In combination with this, there should be a book kept with a record of all the special fixtures, giving the number of each, and an idea of what it is for.

◆

Cyrus Buckland.

Cyrus Buckland, one of the best known mechanics of this country, died recently at Springfield, Mass., at the age of 92 years. Mr. Buckland, whose achievements were referred to by Mr. B. F. Spalding, in his review of the "American System of Manufacture," published in these columns last year, devoted his talents mainly to improvements in the system of manufacturing small arms, in which he was notably successful, his devices and tools for making gun stocks and other parts of small arms being now used all over the world where such work is done. He was at one time at the head of the Springfield Armory, but retired years ago, in order to reap the full benefits from his numerous patents. It was Mr. Buckland, who, in 1855–6, solved the problem of so threading the barrels and breech pins of muskets, that the pins and barrels would interchange. His machinery for doing this he sold to the government. The ideas and principles made use of by him in his gun machinery have, of course, been largely made use of in every branch of manufacturing, especially on such work as sewing machines, and other articles manufactured upon the system of duplicate and interchangeable parts. The benefits which he has conferred upon the world are simply incalculable.

◆

R. D. Nuttall & Co., machinists, Allegheny, Pa., are widening their present machine shop building 20 feet along its entire length. Part of the additional space will be devoted to tool-room and shop purposes, while a room 32x20 feet will be set apart for use by the men. It will contain chairs, tables and reading appliances. In it drawing lessons may be had by the apprentices and others desiring them. Mr. Nuttall is a young machinist, who started with about $100 capital a few years ago, is now employing 60 men, and doing a good business.

◆

Last week a stoppage occurred on the City & South London Railway which was the cause of considerable annoyance, as it was at a rather busy part of the day. Those connected with the line had, however, the most cause for feeling the annoyance, the cause of the stoppage being of such a very simple and easily remediable kind. There is a lock nut on the armature spindle of the motors, between the armature and the brass bearing at one end. This nut, like a good many other lock nuts, unlocked itself, and turned back until it touched the brass bearing. When this occurred the direction of rotation of the armature spindle soon caused the nut to lock hard against the brass, and ultimately to fix the spindle absolutely. The cause was not ascertained until the engine had been hauled away, with the drivers fixed, by another engine. It might have been put right in five minutes, if the real cause had been guessed, but it was too simple a cause to be guessed very readily. It was simply a bit of electro-mechanics without the least bit of mystery.—*London Engineer.*

◆

A new and novel application of electricity to the rapid transit problem has been made by a Chicago man. He does not propose to use the electricity as the motive power, however, but simply as a regulator, so to speak.

Old-fashioned horses furnish the motive power, and the electric battery is placed in the carriage, and wires so arranged that either a mild stimulating current can be passed through the horses, calculated to quicken their speed when necessary, or, should they conclude to run away, they can, by simply pressing a button, be shocked so severely as to bring them to their haunches, and while they are then making up their minds whether or not they have really been struck by genuine lightning, the perpetrator of the joke can make his escape.

◆

Perhaps it is just possible that our machinery friends are not making as full use of the word parlor as the custom of the day would seem to allow. The word seems to be applied to apartments in which almost any kind of business is transacted, and we have "parlors" of every imaginable description, including "bathing parlors," "corset parlors," "shoe parlors," "hair-dressing parlors," "billiard parlors," and so on. Why doesn't some one open a machinery parlor, or an iron founding parlor, or a forging parlor? There seems to be a crying need for some such institutions, if the men interested in such industries are to keep up with the procession.

◆

Every week we receive a number of letters from men who fail to give their complete address. We cannot give attention to such letters, and we again urge upon all our correspondents the necessity of giving their addresses. It does not follow that we shall use these, but we must have them. Those who sign themselves "X. Y. Z.," or letters to that effect, need not be surprised that no attention is paid to their communications.

◆

Some idea of the magnitude of the sewing machine interests may be gathered from the fact that the Singer factory at Elizabeth, N. J., is turning out 1,500 machines a day, which means two and a half machines a minute. The same company has a number of other factories besides this one, the output of which we do not know. Besides, there are all the other kinds of machines, whose name is legion.

◆

A correspondent who asks about testing iron in a foundry will find information that will probably be satisfactory to him in the American Machinist of May 15, 1886; October 30, 1886; April 17, 1886; June 6, 1889, and September 19, 1889.

◆

A committee from Baltimore recently visited New York to learn something about putting electric wires underground. Better have come to learn how not to do it.

◆

The New York, New Haven & Hartford Railroad Company, it is said, is arranging to equip all its cars with steam heating appliances.

◆

The Guion steamships will hereafter sail from New York Saturday instead of Tuesday.

Machinists' Supplies and Iron.

New York, March 7, 1891.

Iron—American Pig—No change of importance has taken place since last week. The coke strike still restricts the supply somewhat, and this affects prices to some extent on some brands. The demand for pig has fallen off somewhat.

We quote No. 1 Foundry, standard Northern brands, $17 to $17.50; No. 2, $15.75 to $17; Gray Forge, $14.25 to $15; Southern brands No. 1 Foundry, $16 to $17.50; No. 2, $15.25 to $16; No. 3, $14 to $14.50.

Scotch Pig—The market continues dull.

We quote Coltness, $24.50; Dalmellington, $22 to $23, and Eglinton, $20.50.

Copper—The market is unsteady, and it is a difficult matter to say what actual values are. For immediate delivery sales are made at 14¼c. to 14½c., and it can be bought for future delivery at 14c. Casting brands are in fairly good demand at 11½c., and in small lots 12c.; Arizona Ingot, 12¾c. to 13c.

Lead—There has been very little business transacted during the week, and the market is steady, values ranging from 4.25c. to 4.35c.

Spelter—No change of importance has taken place. Spot quotations are 5.05c. to 5.10c.

Tin—The market is dull, and values for spot delivery are 19.7c. to 19.9c.

Antimony—The market has become settled, and prices are somewhat higher.

We quote Hallett's, 16¼c. to 16½c. Cookson's, 18c. to 18½c.; L. X., 17c.

Lard Oil—Prices for Prime range from 49c. to 50c., according to brand.

⁕ WANTED ⁕

"Situation and Help" Advertisements only inserted under this head. Rate 30 *cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.*

Wanted—Agents for fine surface gauges; big profits. Address E. G. Smith, Columbia, Pa.

Graduate, exp'd experimenter, inventor and draftsman, desires change in position. J. H. K., AM. MACH.

Exp'd. mech. draftsman with technical education and shop exp., wants position. Box 63, AM. MACH.

Wanted—By prac. mach., position as foreman, or charge of erecting engines & power plants; familiar with water-works machinery. Box 64, AM. MACH.

Wanted—Position as traveling salesman for machine tool builder; will sell either on commission or salary. Address Peter Shellenback, 424 N. 14th st., Richmond, Ind.

Wanted—Foreman for iron foundry running 60 molders on pipe fittings and valves. Address, giving references, and salary required. Box 50, AM. MACHINIST.

Wanted—First-class mechanical engineer and draftsman, that has had experience in locomotive construction; permanent position guaranteed to right party. Address "Locomotive," AM. MACH.

Wanted—First-class tool and lathe hands for night turn in a first-class shop; a few also will be needed for day turn. Address Joseph Martin, Sparrow's Point, Maryland.

Wanted—Two first-class all around machinists for light brass and iron work; quick workmen; permanent place; state salary. Minneapolis Brass and Iron Mfg. Company, Minneapolis, Minn.

Wanted—A general foreman for a Western manufacturing company; one familiar with steam fitters' supplies preferred; must be well posted in iron-working mach'y, & fully competent to handle men advantageously. Address Box 49, AM. MACHINIST.

Wanted—A number of first-class machinists to work on ice and refrigerating machinery, and stationary engines; good wages and steady work to first-class men. Address Frick Company, Waynesboro, Franklin County, Pa.

Wanted—Three or four boys to learn the machinist's trade, not less than 17 years of age, and to have a fair common school education. Application must be made in own hand-writing. The Hendey Machine Company, Torrington, Conn.

A pushing, practical foundry foreman with good executive ability in handling work and men, well up in mixing and melting metals, core making and general foundry knowledge, wants position; engine work or heavy machinery preferred. American, temperate, age 36, references A 1. Address Box 56, AMERICAN MACHINIST.

Mechanical man, draftsman and designer; machine tools and engines; indicator work and estimating; technical education and practical exp., young, best of references, and reasons for changing; not afraid of hard work; wants engagement with reliable firm, April 1st. Address Mechanic, 258 E. Eagle street, Buffalo, N. Y.

✠ MISCELLANEOUS WANTS ✠

Advertisements will be inserted under this head at 35 *cents per line, each insertion.*

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Just out: aluminum steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Screw cutting lathe, 17″ swing, 6' bed, $75. Great sacrifice. Bate, 133 Huntington street, Brooklyn.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Pulsometer Pumps—Several sizes, nearly new, cheap; 8 horse-power Lidgerwood hoister, large water motor, exch'g. 165 First st., Jersey City, N. J.

American firms having specialties suitable for the mfg. districts of Lancashire and Yorkshire, England, write in to Bancroft & Horsfall, consulting and general engineers, Commercial st., Halifax, Eng.

Wanted—To arrange with suituable party to manufacture, either on royalty or by sale of patent, the split collar and lock nut illustrated in this issue AMERICAN MACHINIST. Address Robert King, care of AMERICAN MACHINIST.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

For sale—One set of Whitworth's taps and reamers, comprising sizes ⅝, 11/16, ¾, 13/16, ⅞, 15/16, 1, 1⅛, 1¼, 1⅜, and 1½″ diameter. There are three assorted taps, and one master tap; and one taper and one straight reamer to each dimension. This set has never been used, and cost $250. We will sell at a sacrifice for $125. Frasse & Co., 92 Park row, N. Y.

BRADLEY HAMMERS AND FORGES
BEST HAMMERS IN THE WORLD RUN BY BELT
OVER 1500 IN USE.
Three Styles, 15 lb. to 500 lb. Heads.
Our FORGES heat irons fast enough to keep Hammers and Men fully employed. Send for Catalogue and Prices.
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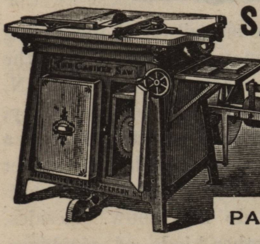

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By WM. J. BALDWIN.
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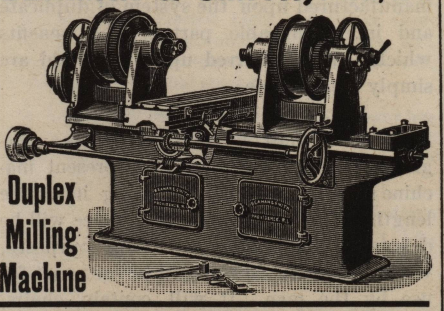
VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

BEAMAN & SMITH, PROV., R. I.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How to get the best results with "R. MUSHET'S SPECIAL STEEL." Greatly increase your speeds and feeds; then compare the work you turn off with that done by any other known Steel. This will make the first cost of "Mushet's" look insignificant.
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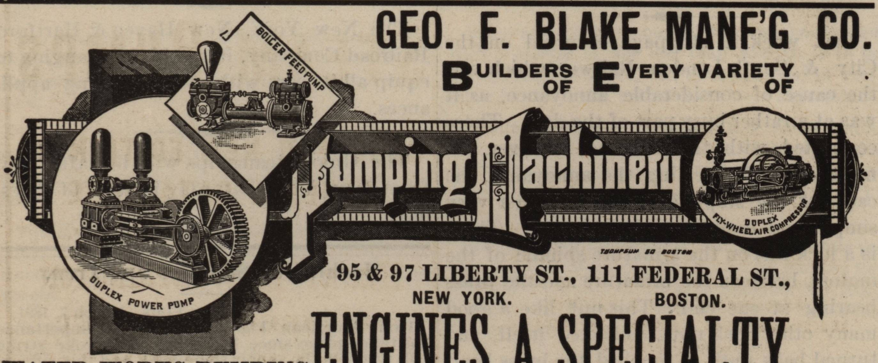
Sole Representatives in the United States.
11 & 13 Oliver St., BOSTON, MASS.

GEO. F. BLAKE MANF'G CO.
BUILDERS OF EVERY VARIETY OF



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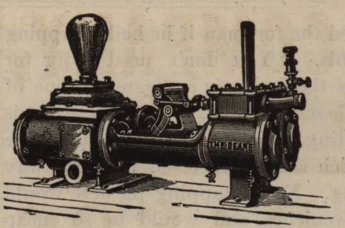

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STEAM PUMPS
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CRESCENT STEEL CO.
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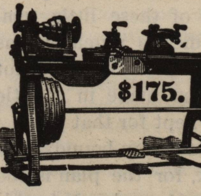
Makers of The Finest Tool & Die STEEL



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MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

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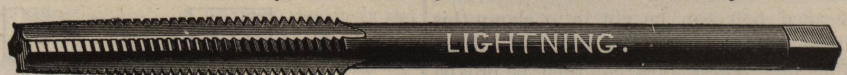
Send for Circular.
Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive
CAN BE FORGED HOT.
Round, square, and hexagon bars for pump, piston rods, bolts and screws. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Spring wire.
ANSONIA BRASS & COPPER CO.,
Sole Manufacturers
19 & 21 CLIFF ST., NEW YORK.

FINE TAPS, DIES, REAMERS, Etc.



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Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-Saving Tools. Send for Price List.
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For TOOLS, DRILLS, DIES, &C.
All Kinds in Stock.
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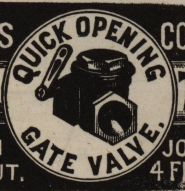
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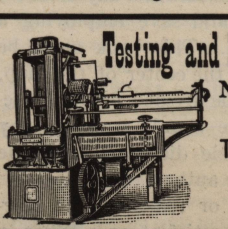

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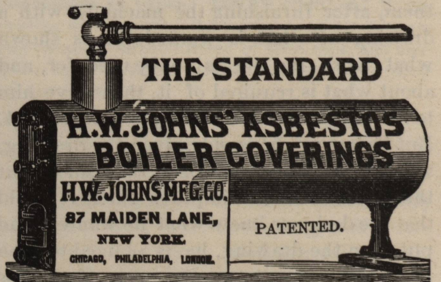
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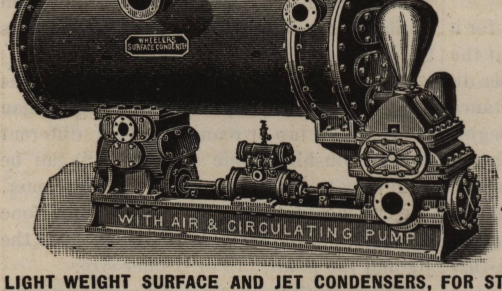

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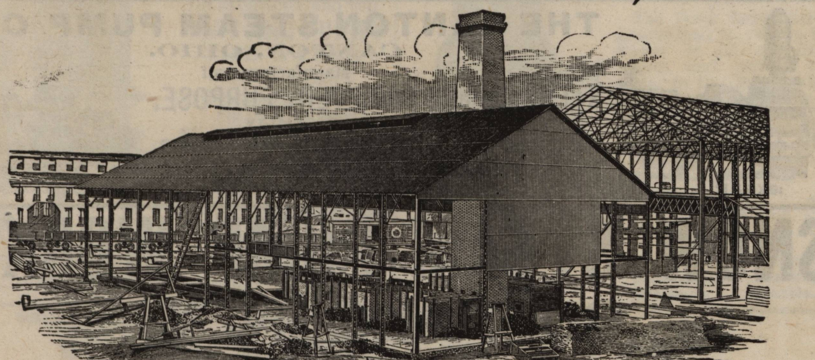

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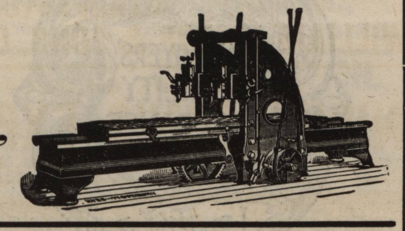

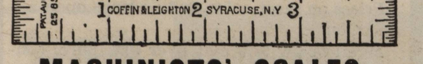

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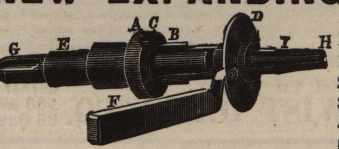

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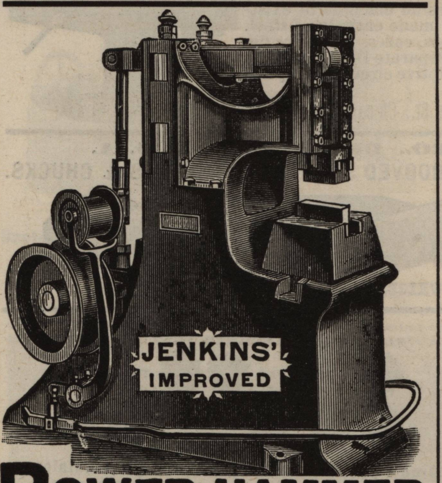

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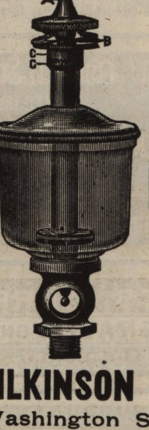

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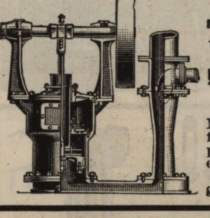

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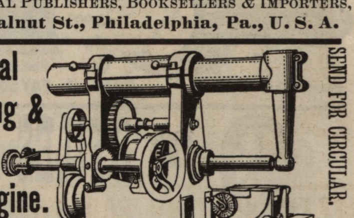

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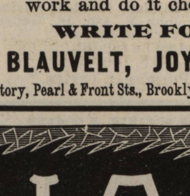

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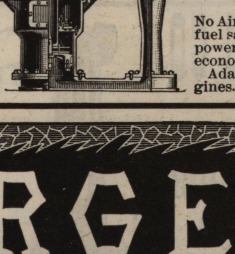

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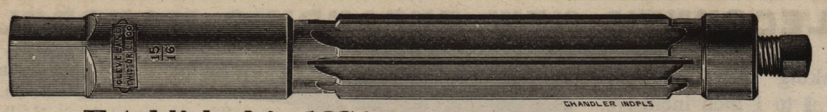

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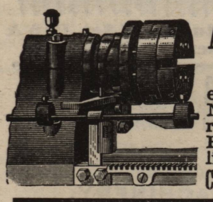

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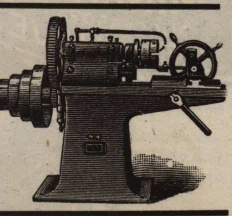

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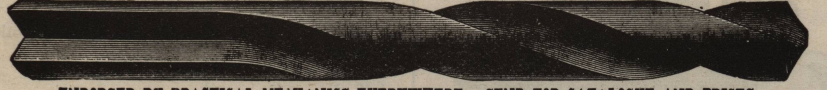

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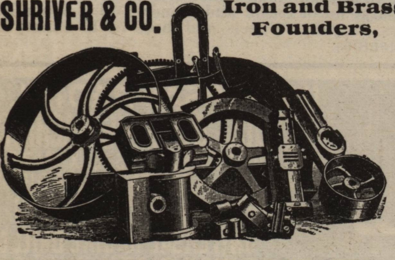

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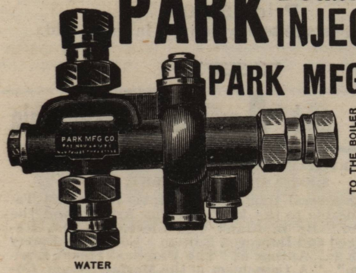

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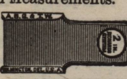

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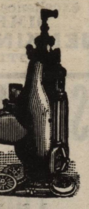

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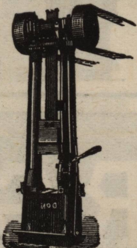

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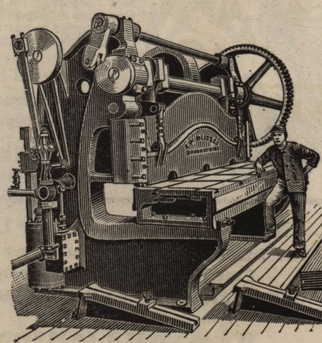

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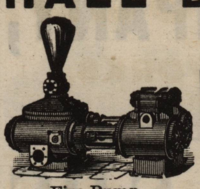

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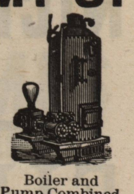

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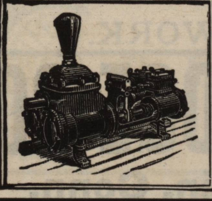

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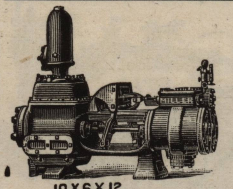

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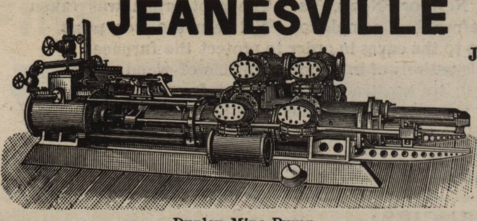

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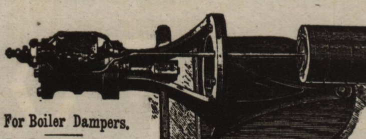

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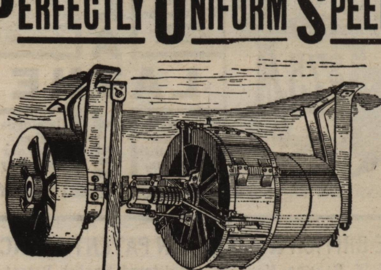

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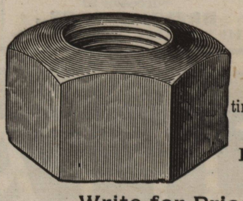

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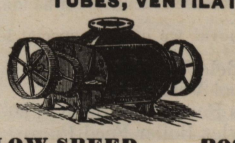

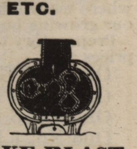

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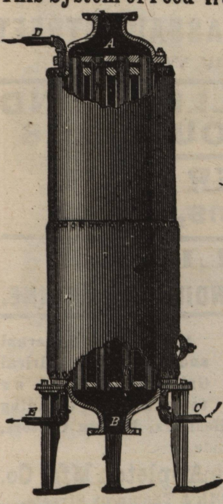

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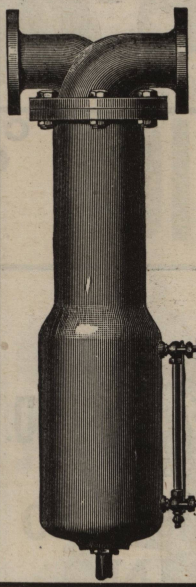

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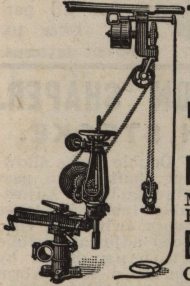

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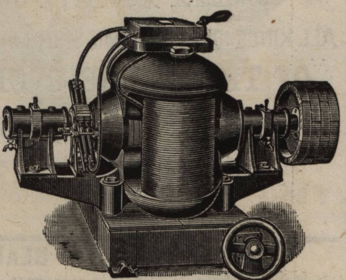

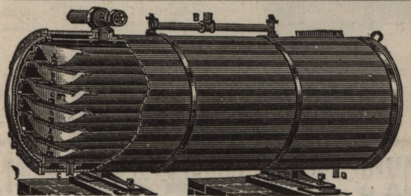

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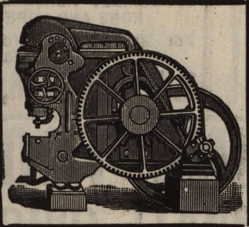

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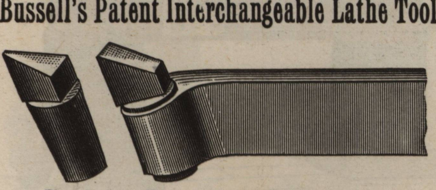

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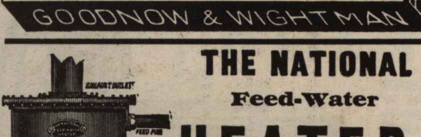

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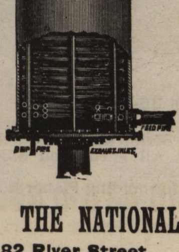

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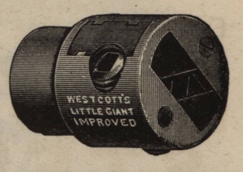

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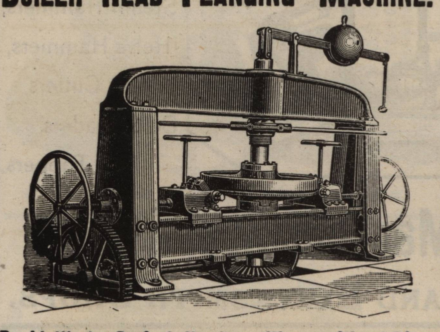

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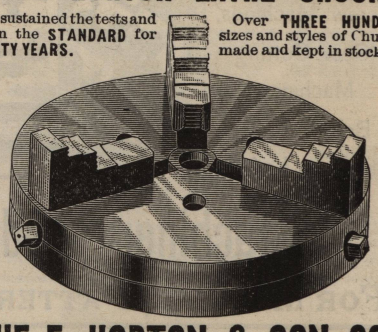

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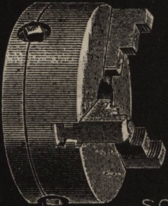

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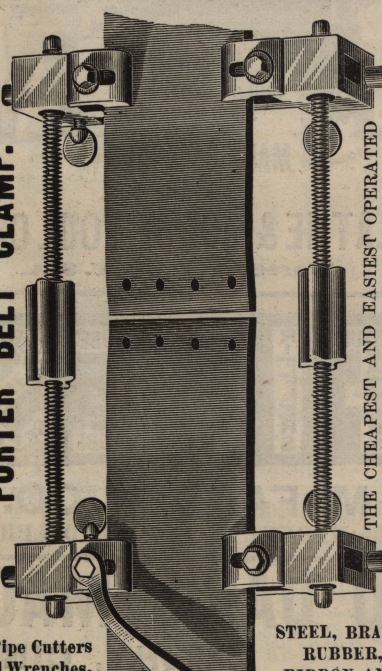

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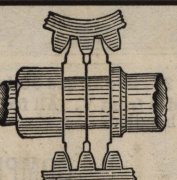

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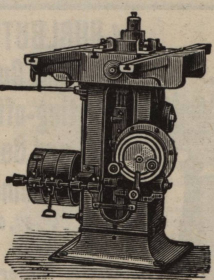

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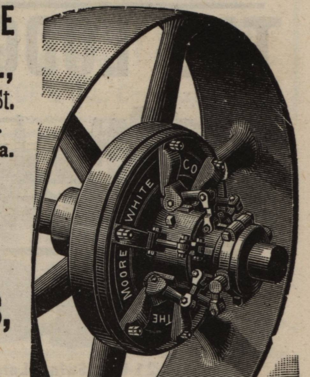

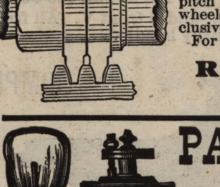

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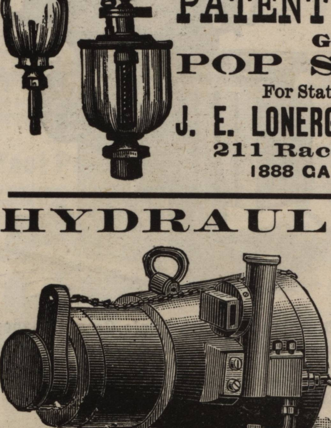

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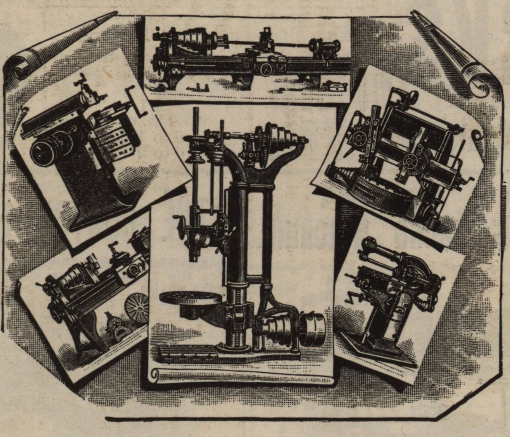

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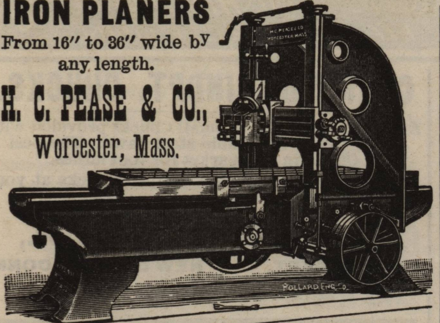

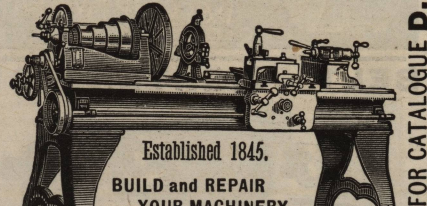

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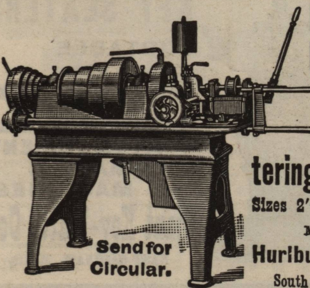

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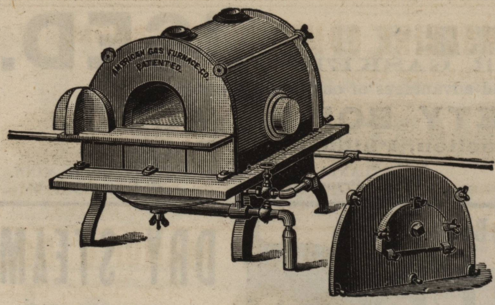

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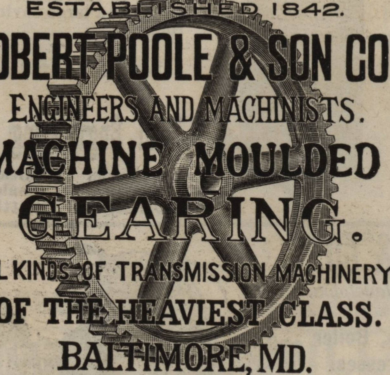

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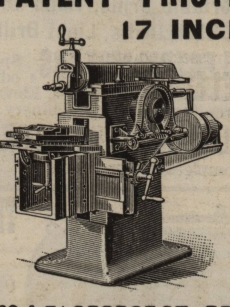

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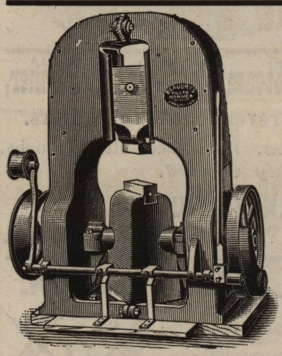

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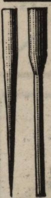

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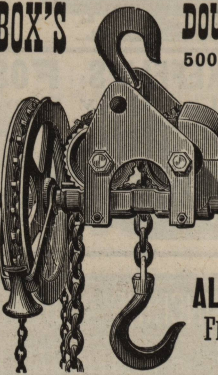

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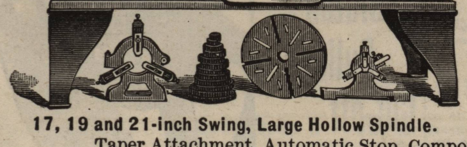

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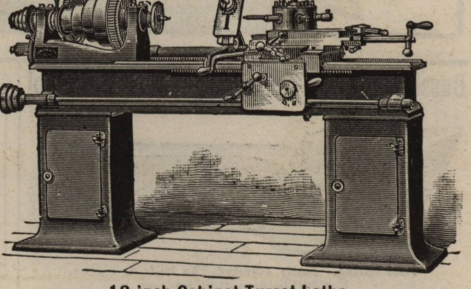

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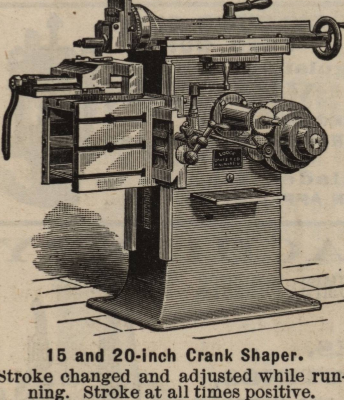

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Stroke changed and adjusted while running. Stroke at all times positive. Invariably plane to a line. Detachable Tables.

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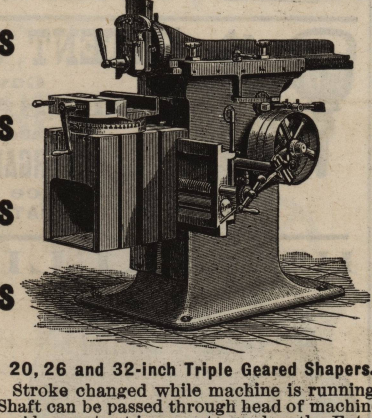
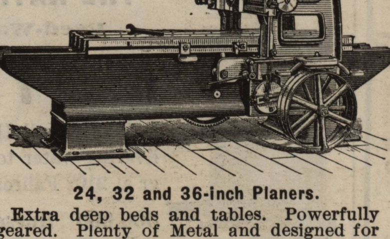


20, 26 and 32-inch Triple Geared Shapers.

Stroke changed while machine is running. Shaft can be passed through head of machine and key seat cut in same to any length. Extra heavy vises. Tables slotted on all sides.



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Extra deep beds and tables. Powerfully geared. Plenty of Metal and designed for extra heavy duty. All Feeds and Shipper operated from both sides. Improved device for holding Planer Bolts.

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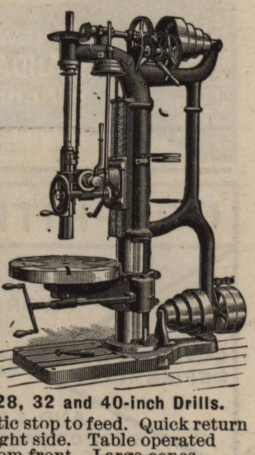

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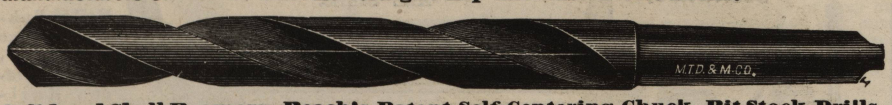

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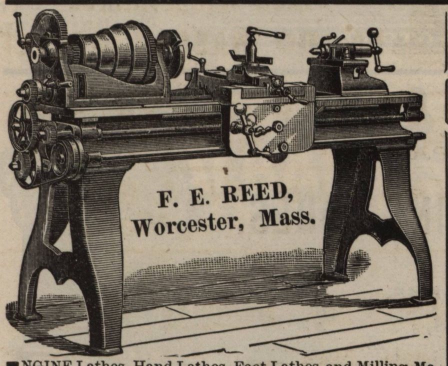

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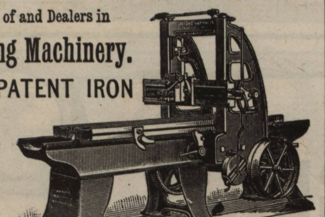

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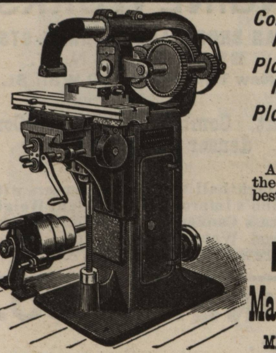

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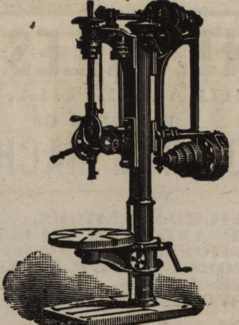

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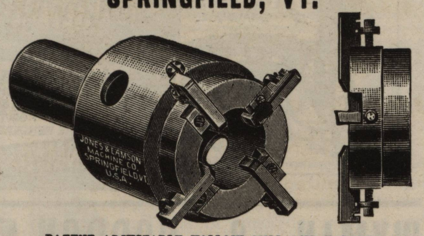
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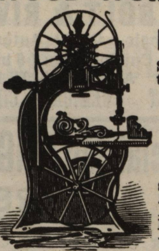

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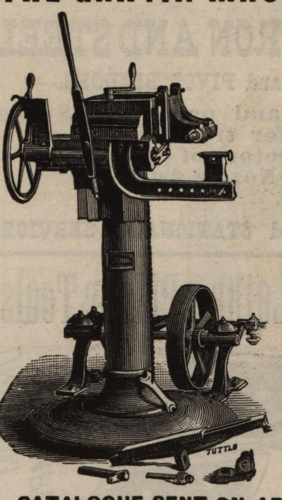

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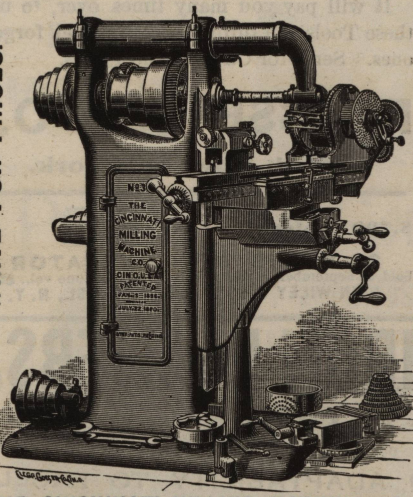

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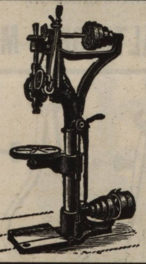

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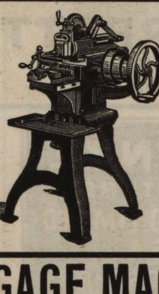

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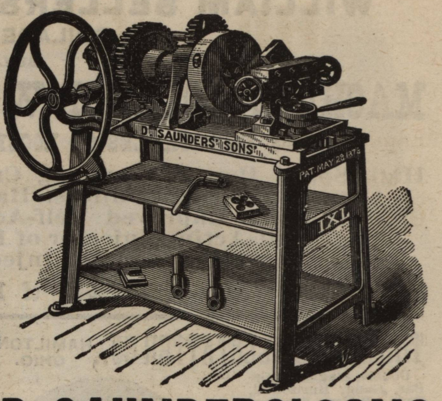

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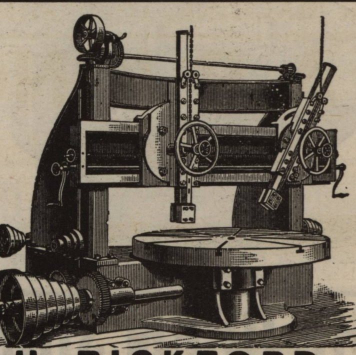

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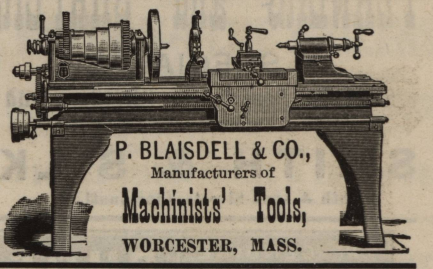

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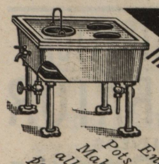

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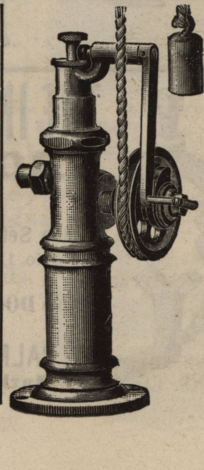

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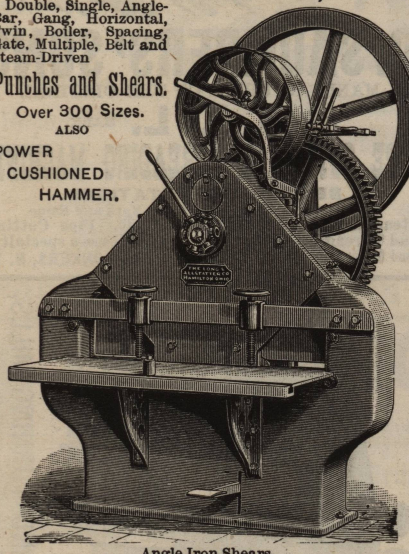
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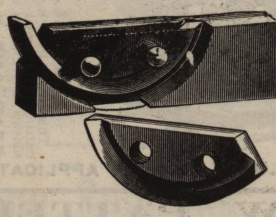

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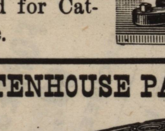

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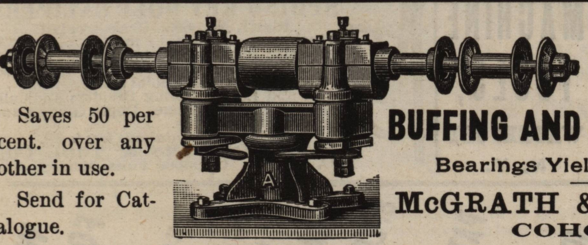

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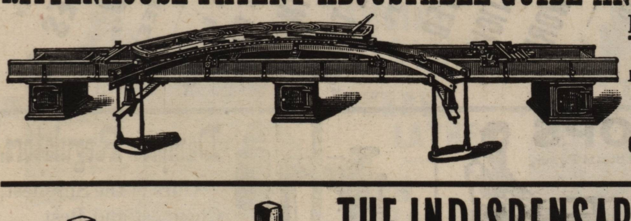

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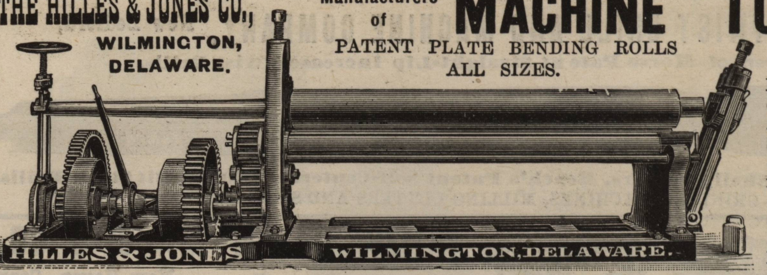

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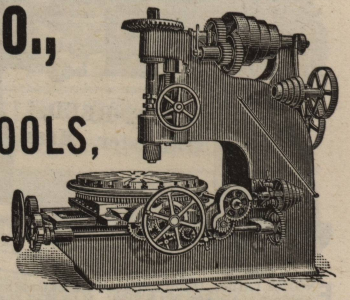

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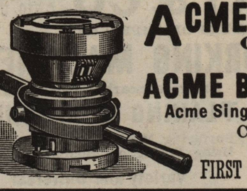

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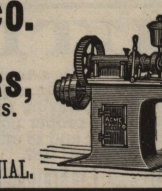
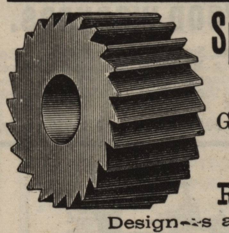


PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.



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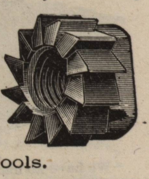

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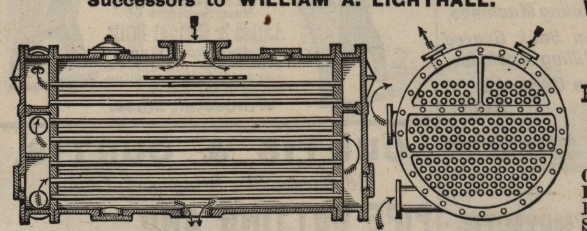

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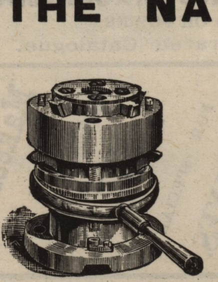

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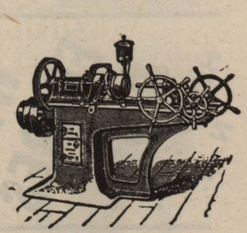

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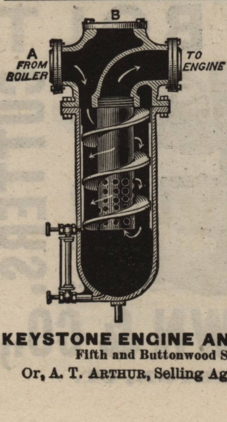

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For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.

Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require; also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.

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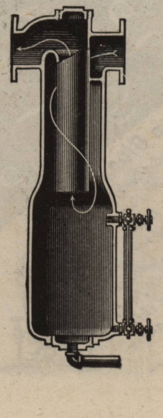

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To your engine or for any other purpose, no matter HOW LONG YOUR STEAM PIPE, or how much your BOILER MAY PRIME. An absolute safeguard. A source of economy.

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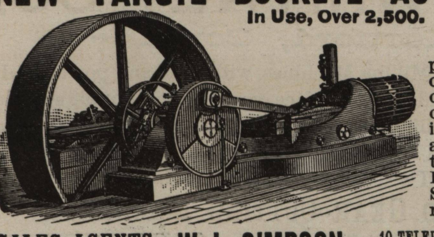

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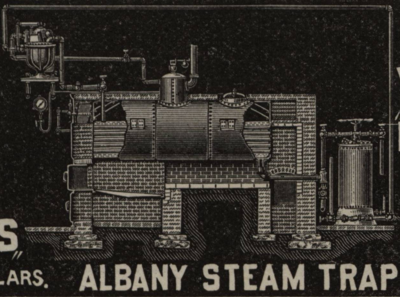

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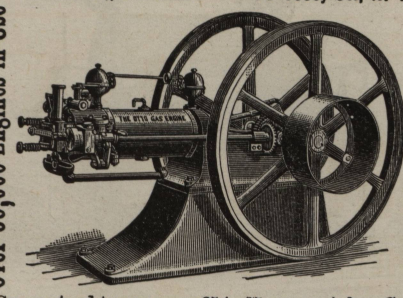

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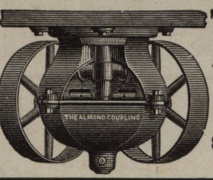

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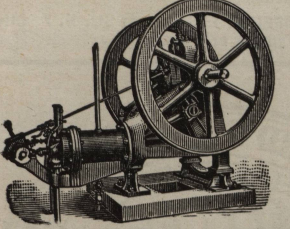

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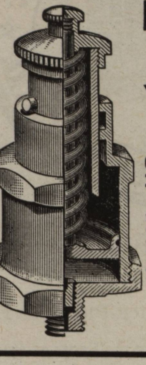

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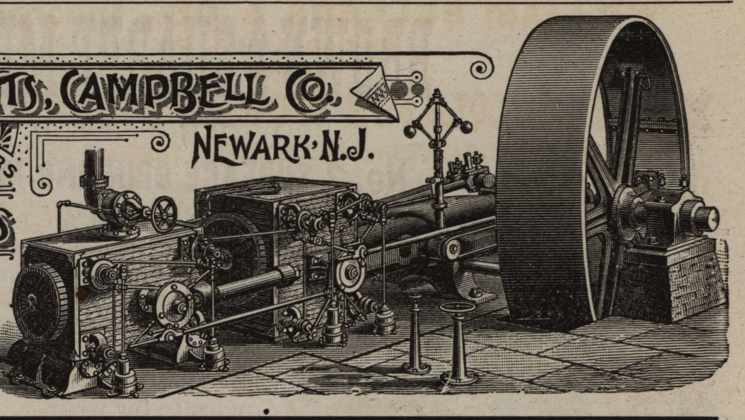

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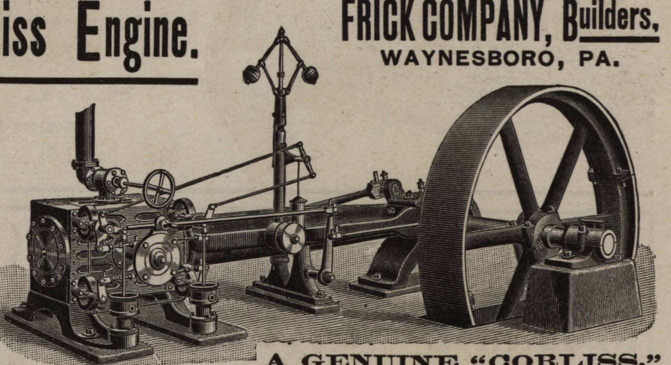

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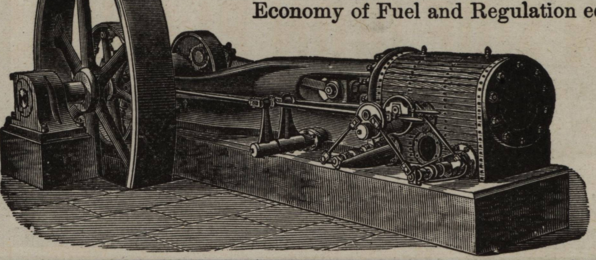

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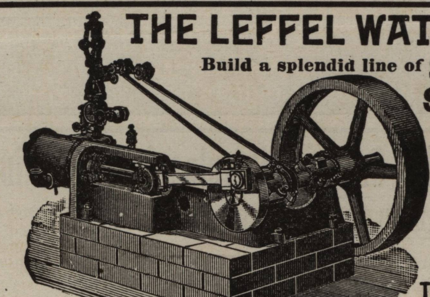

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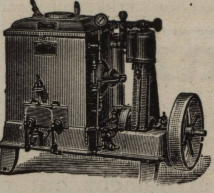

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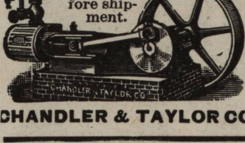

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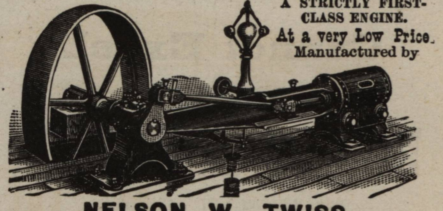

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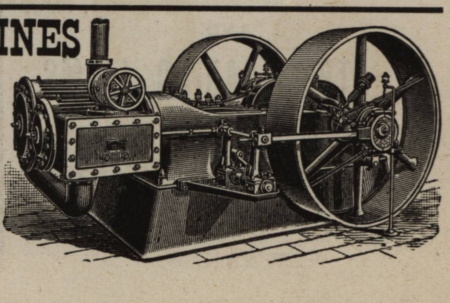

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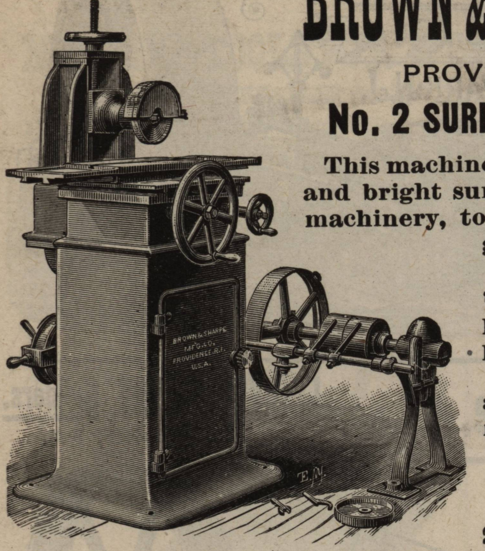

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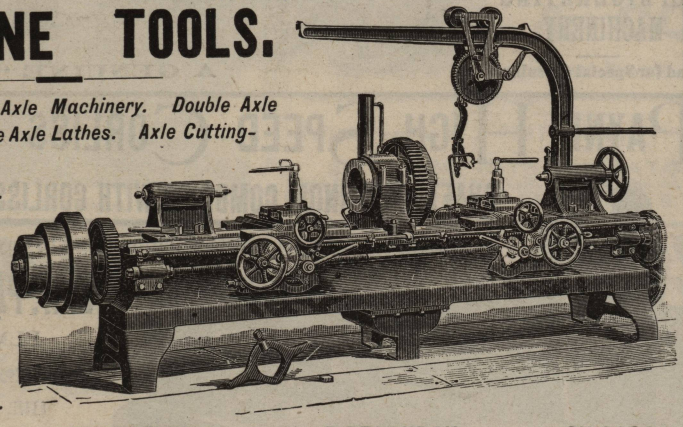

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Competition open to every one, except those in our employ. Communications may be addressed to either of our houses.

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New York City.

The Lodge & Davis Machine Tool Co.,
Works: CINCINNATI, OHIO.
N. B.—See "Advertisement," page 16.

Western House,
No. 68 & 70 S. CANAL ST.,
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OTHERS can copy, but they

Cannot Excel.

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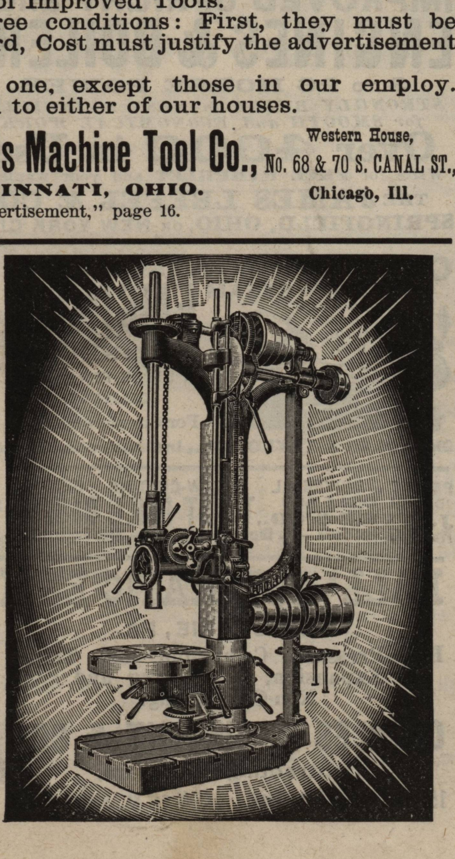

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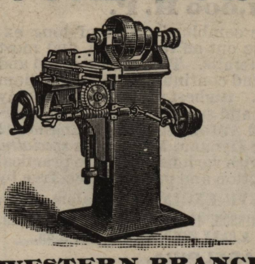

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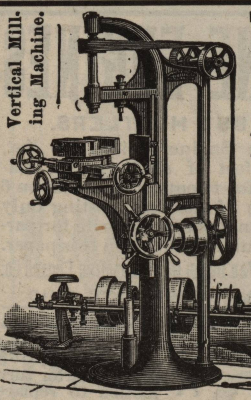
DROP FORGINGS
Of Every Description, of Bronze, Copper, Iron and Steel.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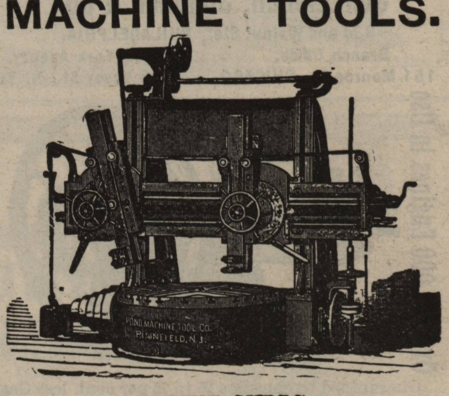
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FROM 16 to 48 IN. SWING.
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WHEELS, ready made.
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CUTTING, light or heavy.
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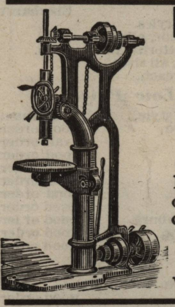

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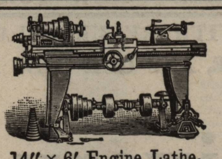
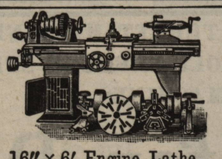
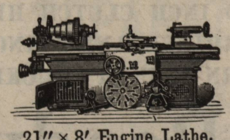


14″ × 6′ Engine Lathe.



16″ × 6′ Engine Lathe.



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